A survey of wild kai consumption in the Arowhenua rohe

NIWA Client Report: HAM2010-098
August 2010

NIWA Project: HRC08201

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Executive Summary

Waterbodies impacted by pollution and suffering environmental degradation represent a risk to the health of both aquatic organisms and humans. Even at low concentrations contaminants, particularly organic compounds, can cause long-term impacts and pose significant risks to the health of biota and humans. Human health may be threatened either by the consumption of food (especially fish and shellfish) contaminated with pollutants, or by direct exposure (via water and atmosphere during collection) to them (Boesch and Paul 2001). This research, funded by the New Zealand Health Research Council over a three year period, ultimately aims to improve Maori health by identifying, quantifying, and effectively communicating the risks associated with the collection and consumption of wild kai.

Wild kai, gathered from the sea, rivers, and lakes, has always been an integral component of Maori lifestyles, but today is increasingly susceptible to contamination. The impacts of environmental contamination in wild kai on Maori have not been investigated to date. The present research sought to address this shortcoming. As part of the first phase of the research, Maori from three communities were asked to identify species, locations and quantities of kai moana, kai roto and kai awa consumed. This was to enable the levels and types of contaminants in the kai to which Maori are exposed to be determined, and pathways of potential contaminant uptake by tangata whenua investigated by analyzing relevant food-chain components.

Three Maori communities were involved in this research: Te Arawa: centred around the Te Arawa / Rotorua Lakes and Maketu coastal area; Ngāti Hokopu ki Hokowhitu: centred around Whakatane; and Te Runanga o Arowhenua: centred on South Canterbury. The three communities differ in their access to and use of aquatic resources. Each community is characterised by different physical, natural, social and political capital which directly impacts on the level of kai awa, kai roto and kai moana gathered and consumed. In each region the diversity of aquatic ecosystems utilised, with spatial and temporal patterns of gathering unique to the each place and community, reflect a history of complex, locally specific tikanga and kawa driven behaviours. Exploring the complexity of this inter-community variation was beyond the scope of this research.

This report documents the results of the first phase of the above research programme, specifically investigating the level of kai consumed by members of Te Runanga o Arowhenua, whose whanau have resided in South Canterbury for centuries. For centuries the rivers, streams, wetlands, lakes and hapua have also been the mainstay of their economy providing freshwater fish, shellfish, waterfowl, and plants.

With respect to the research design drawing on the earlier work of Bebbington (1999), importance of kai to whanau was examined using standard interview techniques according to:

- the instrumental role – the significance of rivers, lakes and coastal environments as a source of physical health (specifically nourishment); and

- the hermeneutic role - the ways in which kai awa, kai roto and kai moana give meaning to the lives of whanau and hapu. Contemporary research seldom examines the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana, which when communicated to policy makers in the absence of empirical data, are often dismissed as anecdotal. Finally, kai awa, kai roto and kai moana (and the waterbodies from which they are sourced) are examined in terms of their cultural embeddedness of whanau and hapu.

All of those interviewed for this research expressed a strong relationship with the lakes the wider terrestrial and marine surroundings. Whakapapa, ancestral connection to the lakes area and ahi karoa remain significant elements of the relationship. Two thirds of the participants spent their childhood in South Canterbury (within the takiwa of Te Runanga o Arowhenua) while two of the participants grew up in the North Island.

A large variety of kai continues to be regularly collected, gifted, purchased and/or consumed. While whanau continue to gather a range of species, it is considerably less than the 38 species that we know from manuscripts were historically obtained from these sites across South Canterbury. Although some resources were gathered seasonally, historically whanau relied on freshwater resources year round. The principal purpose of the Kai Consumption Survey was to determine the extent of gathering by whanau living in the South Canterbury region. Consistent with a kai gathering lifestyle:

- 78.5% grew their own vegetables.

- Of the 78.5%, 57% of those who grew vegetables also grew fruit.

Having determined that all of respondents do consume different types of kai:

- 40% of respondents said they now only eat kai on special occasions; while

- 18.9% eat kai less than once a month; and

- 22.3% eat kai 1-3 times per month.

In other words 81.2% eat kai 1-3 times per month or less.

In addition to identifying the species gathered, the sites from which kai was sourced were identified. These sites were then used as the basis for a sampling programme which examined contaminants in sediment and kai. Kai was gathered from 13 waterbodies across the region. Approximately 47% of

participants gather from the Temuka River, while the Opihi River (upstream of State Highway 1, downstream of the State Highway, and the river mouth) is used by 30%, 28% and 37% respectively.

If kai moana, kai awa and kai roto are to be promoted as a beneficial source of food for whanau, there need to be sufficient quantities of healthy stocks in order to sustain gathering. Questions in the Kai Consumption Survey asked whanau to provide their assessment of the stocks of various species gathered. Of concern, 54% of respondents believed that across all species gathered there were now a "lot fewer" available while another 17.9% believed that abundance was "slightly fewer".

Whanau were asked to identify their preferred kai. Surprisingly, the top 6 preferences according to the ratings (in order of preference) were:

1. snapper, koura
2. kina
3. trout
4. pupu, pipi, cockles, herrings, oysters.

There is little data available to enable calculation of pre-European contact per capita consumption of kai. Even if it was possible to determine harvesting levels for particular species, it is difficult to calculate how much food (and what species) on top of this would have been received as a gift or obtained through trade. For the calculation we assumed that historically wild sourced kai would have been consumed on average once per day. From interviews we know that wild sourced kai was consumed "at least 3 times" per week in the 1970s and 1980s. Some whanau, however, eat kai daily. However a crucial time period – around the 1970s and 1980s – marks a significant change in the quantity of kai consumed as interviewees confirmed that more convenience foods started to appear in whanau diets. From the interviews this coincides with observable deteriorations in the health of aquatic habitats. Again to enable a calculation of kai consumption in the mid twentieth century we have assumed kai was consumed 3 times per week.

With respect to contemporary consumption, from the Kai Consumption Survey, all respondents still consume kai awa, kai roto, or kai moana. The quantities available fall far short of historic levels and the levels desired by whanau who wish to engage in mahinga kai practices, although they exceed average New Zealand consumption rates (32.87g per person per day).

Kai consumed historically	Equals 230.77 per person per day
Kai consumed up until 1970s &1980s	Equals 98.63g per person per day
Kai consumed today	Equals 43.81g per person per day

Part of the reduction in quantities consumed can be attributed to environmental degradation. A species will show signs of dwindling for a while and then suddenly decline because its population is no longer self-sustaining.

Major changes in mahinga kai gathering behaviours began some 160 years ago with European settlement. Newly introduced foods replaced wild sourced kai principally because of the relocation of whanau and hapu to reserves, their assimilation into mainstream New Zealand culture, and damage to the resource base resulting from use and development of resources by the newly arrived settlers. Interestingly many of the sites still utilised by whanau are found in close proximity to reserves and easements.

Although the initial loss of land occurred in the mid eighteenth century the interviews with whanau members (especially kaumatua) confirmed that they gathered many species until relatively recently and they believed that the most damaging changes occurred within the last generation. These observations confirm the period of 1970-1980 as a time of change.

The alienation of lands and resources has seen the mahinga kai practices of Ngai Tahu transformed. This transformation occurred at a time when resource degradation and environmental crises have precipitated the search for alternatives to dominant management systems (Berkes, 1991, 1994; Pinkerton, 1989). Traditional knowledge (or in the New Zealand context Matauranga Maori) is increasingly promoted as a valuable addition to scientific knowledge. However it must be recognised that the application of Matauranga has been disrupted and subject to interference. Nevertheless for some whanau, for some resources, in some areas, there has been regular, relatively uninhabited resource use through the generations. As the interviews and Kai Consumption Survey show many Ngai Tahu continue to gather and consume kai awa, kai roto and kai moana.

The fact that kaumatua contend that the most damaging changes have occurred in the current generation when considered alongside the data showing that the 10% of respondents who don't eat kai are all rangatahi suggests the assimilation of Maori into mainstream New Zealand lifestyles and diets is continuing and that the loss of some mahinga kai practices may be quite marked in younger whanau members.

In South Canterbury, the declining abundance of aquatic species at many sites across Canterbury is attributed to water quantity issues arising because of excessive extractions, changes in flow patterns as a result of damming, and demands to divert or drain waterbodies. This clearly has the potential to place Ngai Tahu in confrontation with development interests as:

- The streams valued and utilised by Ngai Tahu are those most stressed.
- Currently 88% of water allocated in Canterbury is used for irrigation.
- Ngai Tahu believe some of the current land uses (that are totally dependent upon water supply) are unsustainable.

Interviewees believed that summer withdrawals leave some stretches of riverbed almost dry. The water is left dribbling in channels and gets lethally warm and polluted with agricultural runoff. Fish migration – upstream and downstream – is also severely compromised. In some catchments fish

survival is dependent on access to isolated and disconnected large pools. Of particular relevance to consideration of contaminant levels, is the reduced assimilative capacity of waterways when only minimum flows are maintained – often for significant periods of time during summer.

More recently Ngai Tahu have been denied access to kai due to increased gathering pressure by ethnic groups who either do not know or respect the tikanga and/or rules that regulate gathering.

Despite the level of environmental change and the potential for contamination, it needs to be acknowledged that lifestyles today leave little time for fishing activities.

Changes to the health of the waterbodies and consequently the relationship of whanau with aquatic resources have resulted in a range of health and wellbeing implications for Ngai Tahu whanui. Although the implications emerge from the data they are quite subtle with some informants describing the effects without explicitly "labelling" it as an effect. However, despite this, the links between aquatic resources and health and wellbeing are evident in the sense that they are 'just below the surface' for many of the participants. It is possible that because the themes presented are widespread amongst the interviewees they are also widespread amongst the rest of the hapū, especially the older members who have experienced a lot more of the changes presented in this report first-hand.

1. Introduction

1.1 Background

Waterbodies impacted by pollution and suffering environmental degradation represent a risk to the health of both aquatic organisms and humans. Even at low concentrations contaminants, particularly organic compounds, can cause long-term impacts and pose significant risks to the health of biota and humans. In the aquatic environment, contaminants transported by the air and in the water are highly likely to be deposited in sediments, where in turn, fish and shellfish are exposed. Contaminants are generally stored in the lipids of biota and can be biomagnified up the food-chain. Human health may be threatened either by the direct consumption of fish and shellfish contaminated with pollutants, or by direct exposure (via water and atmosphere during collection) to them (Boesch and Paul 2001).

Concerns about the potential accumulation of contaminants in fish and other wildlife, which commonly form a component of indigenous peoples' diets, and their consequent potential effects on human health, has led to a worldwide proliferation of studies examining the effect of environmental contaminants on fish, wildlife and communities. For example, leading international indigenous contaminant research programmes, e.g., the Northern Contaminants Programme (NCP) and the Effects on Aboriginals from the Great Lakes Environment (EAGLE) Project were established in response to concerns regarding the exposure of humans to elevated levels of contaminants in the traditional subsistence diets of indigenous peoples. Research to date has shown that certain indigenous communities have elevated contaminant levels due to exposure through their traditional diet (Hoekstra et al., 2005; Johansen et al., 2004; Odland et al., 2003; Van Oostdam et al., 1999; Van Oostdam et al., 2003). In addition, fish and wildlife are used as indicators of the health of the ecosystems.

The impact of environmental contamination on the resident "wild kai", and in turn, on Māori iwi/hapū consuming them, has not been investigated to date. A recent review of wild food in New Zealand identified gaps in knowledge of contaminants in non-commercial wild-caught foods, especially in terms of consumption levels (and hence exposure) (Turner et al., 2005). A resulting draft position paper identified a need for information and education on contaminants in kai (NZFSA 2005). In response, the National Institute for Water and Atmospheric Research (NIWA), in conjunction with Tipa & Associates and iwi research partners, Ngāti Hokopu ki Hokowhitu, Te Arawa Lakes Trust and Te Runanga o Arowhenua initiated a programme of research to investigate the contaminant levels and risk to Maori health associated with 'wild kai' – food gathered from the sea (kai moana), rivers (kai awa), and lakes (kai roto). This research, funded by the Health Research Council over a three year period, ultimately

aims to improve Maori health by identifying, quantifying, and effectively communicating the risks associated with the collection and consumption of wild kai.

1.2 Research Rationale

Traditionally, Maori had their own knowledge systems of how the environment contributed to health and well-being. Wild kai, gathered from the sea, rivers, and lakes, has always been an integral component of Maori lifestyles, but today is increasingly susceptible to contamination. The impacts of environmental contamination in wild kai on Maori have not been investigated to date. The present research sought to address this shortcoming.

As part of the first phase of the research, Maori from three communities were asked to identify species, locations and quantities of kai moana, kai roto and kai awa consumed. This was to enable the levels and types of contaminants in the kai to which Maori are exposed to be determined.

While it could be argued that contamination of wild kai has the potential to directly impact the physical health of Maori, the impacts of contamination and/or loss of an important cultural activity on wellbeing have also been explored during the course of the project. Maori associate their well-being as individuals and as members of whanau, hapu and iwi, with maintaining the health of the natural environment (Durie 1994, 1998, Panelli and Tipa 2007, 2008). Maori strongly believe that the whenua and tangata are inextricably intertwined, and when one of these becomes unbalanced, the other equally suffers (Harmsworth and Warmenhoven 2002; Sims and Thompson-Fawcett 2002). Therefore, the sustainability of the natural environment and the long-term well-being of Maori are seen by some Maori as one and the same thing (Panelli and Tipa 2007). This is consistent with conceptualisation of wellbeing proposed by other indigenous communities (Adelson 2000, Greiner et al., 2005, McLennan 2003, McLennan and Khavarpour 2004, McGregor et al., 2003). Customary and recreationally gathered "wild kai" resources are therefore of significant cultural, recreational and economic importance in both traditional and contemporary Maori society (Waitangi Tribunal 1983, 1984, 1987, 1988, 1989, 1991, 1992, 1995, 1998)[1].

The majority of the international research in the area of contaminants in the traditional diets of indigenous peoples has primarily focused on the levels and health effects of exposure to heavy metals and organochlorine contaminants through the consumption of marine fish and mammals in peoples from the northern hemisphere, i.e., the Inuit people of northern Alaska, Canada and Greenland (Hoekstra et al., 2005; Johansen et

[1] The evidence submitted to the Tribunal by Iwi, and the summary reports from the Tribunal itself provide a graphic depiction of the significance of gathering kai for whanau, hapu and iwi.

al., 2004; Odland et al., 2003; Van Oostdam et al., 1999). Research to date has shown that certain Inuit communities have elevated contaminant levels (e.g., mercury, lead and chlordane) due to exposure through their traditional diet (Van Oostdam et al., 2003).

It is unlikely that contemporary Maori communities have been exposed through their diet of "wild kai" to the levels of organochlorine contaminants as high as those observed in indigenous populations residing in the northern hemisphere (due to occurrence of large mammals in the customary diet of Inuit). However, the impact of environmental contamination on the resident "wild kai" and, in turn, on Māori iwi and hapu consuming them, has not been investigated to date. In addition, while existing consumptive advice is available for some species of relevance to Māori, this advice is based on average national consumptive patterns and doesn't account for potentially higher consumption rates of specific traditionally harvested foods by Māori, with its concomitant elevated exposure risk. Māori utilise kai from rivers, lakes and the oceans (as well as the land).

This research aims to identify and communicate the risks posed by the presence of environmental contaminants in the kai moana, kai roto and kai awa to the Maori communities that gather these resources. Major outcomes of the research will be development of a generically applicable risk assessment framework, and Maori-targeted risk communication strategies. It is envisaged that the research will be of interest to the wider Maori community, non-Maori, public health providers, as well as indigenous peoples worldwide for whom fish and shellfish constitute a major part of their diets.

1.3 Research aim

The overall aim of our research project is:

> *To determine to what extent locally available kai moana, kai roto, kai awa, and the associated aquatic environments pose a health risk to tangata whenua.*

Successful frameworks for undertaking research in a manner that is culturally acceptable, and which ensures the protection of intellectual property rights, were developed between NIWA and Ngāti Hokopu and Te Arawa during the HRC and FRST funded programmes 'The Revitalisation and Enhancement of Matauranga Hauora of Aquatic Environments (C01X0226)' and 'Sustainability and Management Framework for Te Arawa Lakes' Customary Fisheries (CO1X0305)'.

Memoranda of Understanding between NIWA and Ngāti Hokopu ki Hokowhitu, Te Arawa and Te Runanga o Arowhenua have been established to formally record the expectations of conduct between NIWA and the respective parties with respect to the present research.

Three Maori communities were involved in the overall research:

- Te Arawa: centred around the Rotorua Lakes;
- Ngāti Hokopu ki Hokowhitu: centred around Whakatane; and
- Te Runanga o Arowhenua: centred on South Canterbury.

These communities were selected on the basis of previous contact (and research projects underway) with key researchers. Permission was obtained and confirmed by a sub-contractual agreement.

The three communities differ in their access to and use of aquatic resources. Each community is characterised by different physical, natural, social and political capital which directly impacts the level of kai awa, kai roto and kai moana gathered and consumed. In each region the diversity of aquatic ecosystems utilised, with spatial and temporal patterns of gathering unique to the each place and community, reflect a history of complex, locally specific tikanga and kawa driven behaviours. Exploring the complexity of this inter-community variation was beyond the scope of this research.

There are four main stages to the research project:

1. Objective 1: The first stage involves interviews with key informants and undertaking a survey to identify what kai moana species are harvested and eaten by iwi/hapu members from Ngāti Hokopu, Te Arawa and Te Runanga o Arowhenua, and the aquatic environments they are currently sourced from.

2. Objective 2: The second stage identifies the types and levels of contaminants present in the “wild kai” and associated habitats identified by Maori.

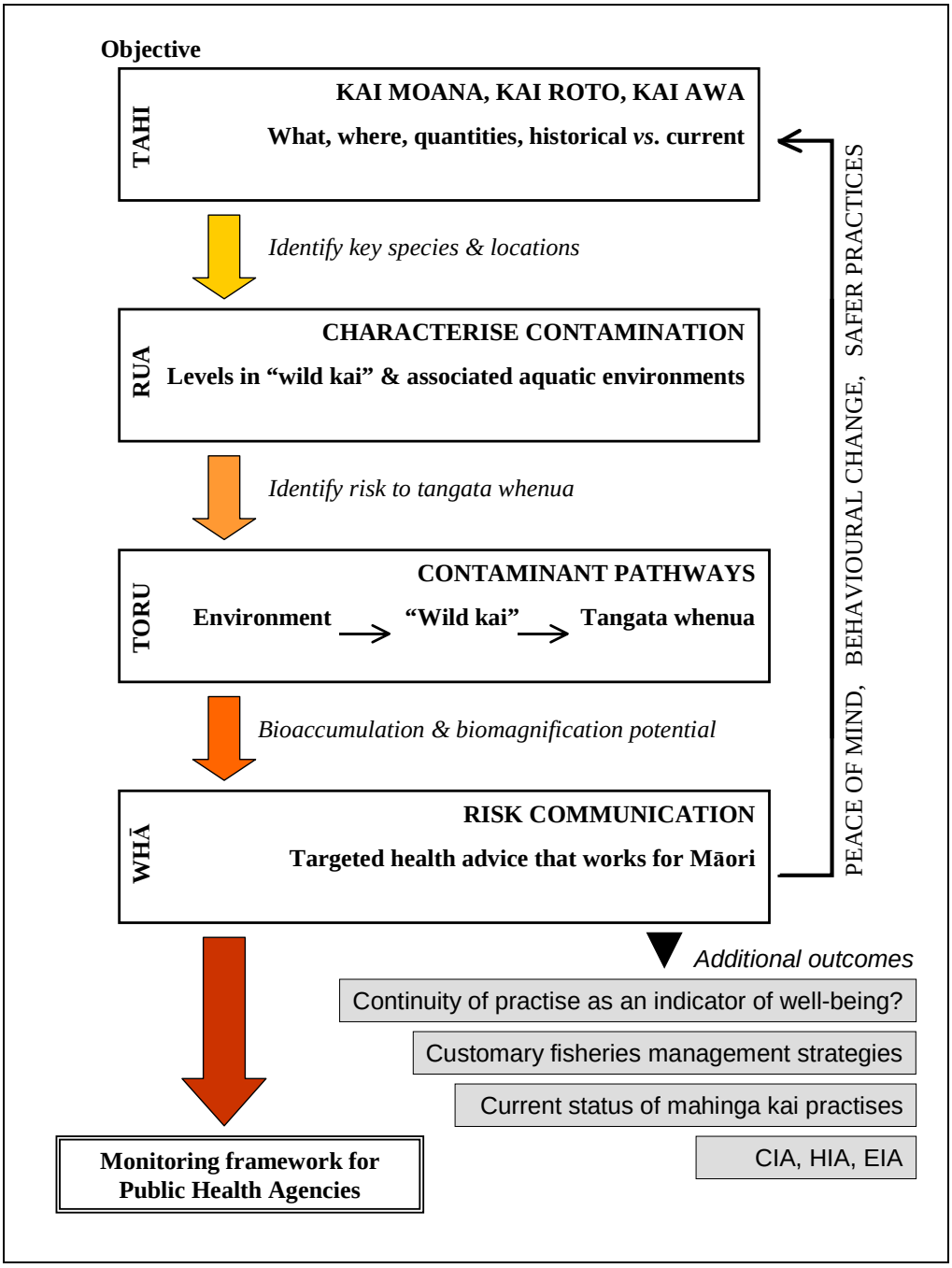
3. Objective 3: This stage establishes potential pathways of contaminant bioaccumulation via the food web utilising methyl mercury as an example of a bioaccumulative contaminant.

4. Objective 4: This stage identifies the potential health risks associated with the collection and consumption of contaminated “wild kai”, and develops risk

consumption advice specifically targeted at Maori, that will take into consideration both the benefits and risks associated with eating kai moana, kai roto and kai awa.

Figure 1 provides a graphic representation of the identified research priorities, the objectives, and possible outputs.

Figure 1: Research priorities, the objectives, and possible outputs.



The first objective of the research (to provide a description of the kai moana, kai roto and kai awa collection, processing and consumption patterns of iwi/hapu members) is clearly a precursor to Objectives 2–4. This first stage identifies:

- What types of kai have been collected and/or eaten in the last 2–3 generations (e.g., species, life-stage, abundance)?
- Where were/are they harvested from and when (e.g., location, ecosystem, season, time of day, life-stage)?
- How is kai moana stored and processed for consumption?

This report documents the results of the first phase of the above research programme, specifically investigating the level of kai consumed by whanau in South Canterbury and the potential effects of environmental contamination on their physical, spiritual and cultural well being.

To elicit the data needed we included methods that have been used previously with hapu around New Zealand. This approach consisted of focus groups and hui, followed by interviews. For this objective it was important to assemble a group of willing participants with knowledge and experience of kai gathering in the takiwa (area) and rohe.

1.4 Report Structure

This report has been divided into a number of sections:

Section 1 Sets out the background and the aims of this study.

Section 2 Describes the methodology that was used.

Section 3 Provides some information on Te Runanga of Arowhenua and their takiwa in South Canterbury region.

Section 4 Outlines international developments within which the research is situated, specifically:

4.1 indigenous communities and participatory approaches to management and research;

4.2 contemporary wellbeing research, and implications for this study;

4.3 international observations of the impact of changing diets;

4.4 effects of contaminants on health;

4.5 Maori conceptualisations of health and wellbeing.

Section 5 Introduces the empirical analysis by outlining the quantitative research results; specifically with respect to contemporary patterns of gathering. This chapter is informed by the Kaimoana Consumption Survey.

Section 6 Based on the results, develops a broader understanding of the importance of kai awa, kai roto and kai moana within the wider socio-economic-cultural activities of whanau and hapu. It provides a brief comparative analysis by discussing the contemporary patterns alongside historic traditional patterns. It pulls together the qualitative and quantitative research results and identifies main themes that are then discussed in the context of international literature.

Section 7 Returns to the original kaupapa of the research and discusses the next steps in the research process. The report concludes with observations of how social, cultural and political meaning associated with kai gathering could inform the management of such resources within the community.

5.1 historic, traditional patterns of gathering;

5.2 changes to traditional lifestyles; and

5.3 contemporary patterns of gathering.

Section 6 Then moves away from presenting the quantitative results to develop a broader understanding of the importance of kai awa, kai roto and kai moana within the wider socio-economic-cultural activities of whanau and hapu. It reflects and pulls together the qualitative and quantitative research results in the context of international literature.

Section 7 Returns to the original kaupapa of the research and discusses the next steps in the research process. The report concludes with observations of how social, cultural and political meaning associated with kai gathering could inform the management of such resources within the community.

2. Methodology and Data Analysis

There is growing recognition of the significance of aquatic habitats and the resources found within them that sustain indigenous communities. Yet this recognition has not been accompanied by investigations to increase understanding of the specific contribution of aquatic habitats and resources to the health and wellbeing of communities depending on these resources.

Drawing on the earlier work of Bebbington (1999), importance to whanau was examined according to:

- the instrumental role – the significance of rivers, lakes and coastal environments as a source of physical health (specifically nourishment); and

- the hermeneutic role - the ways in which kai awa, kai roto and kai moana give meaning to the lives of whanau and hapu. Contemporary research seldom examines the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana, which when communicated to policy makers in the absence of empirical data, are often dismissed as anecdotal. Finally, kai awa, kai roto and kai moana (and the waterbodies from which they are sourced) are examined in terms of their cultural embeddedness of whanau and hapu.

This section of the report outlines the methodology employed, but starts with a description of the Maori community studied.

2.1 Study area

As previously stated, this report details the results of one case study: Te Runanga o Arowhenua. Participants living in South Canterbury were recruited from Te Runanga o Arowhenua members. Availability to take part in the research was the only exclusion criteria, although the preference was for key informants to be active kai gatherers. The study was undertaken under Ethics Approval MEC/07/07/088 and all participants gave written informed consent.

2.2 Methodology

The research team utilised two research methodologies to contrast the instrumental and hermeneutic role of aquatic resources as a source of kai awa, kai roto and kai moana. The first was a quantitative survey of wild kai consumption using a questionnaire, while the second incorporated participatory research techniques via a focus group and a series of qualitative interviews.

The survey followed once the interviews were complete. This was to ensure that the sites and species about which data was sought in the questionnaire were identified by the hapu, and not predetermined by researchers.

2.3 Quantitative survey - Kaimoana consumption survey

The Kaimoana Consumption Survey questionnaire was adapted from a range of other studies (including diet surveys, fish consumption surveys, traditional use surveys, surveys of the health of indigenous communities and perception/preference surveys). The survey questionnaire was approved as part of the Ethics Committee approval process.

2.3.1 Kaimoana consumption: quantifying importance of sites and species

We examined consumption using a food frequency questionnaire with frequency categories ranging from less than once per month to one or more times per day. Consumption is one of the principal means by which the importance of kai awa, kai roto and kai moana and the intimate and dependent relationship with aquatic environments from which they are sourced can be determined.

2.3.2 Existing estimates

Kaimoana consumption records in New Zealand are sparse. Estimates were derived using data from the questionnaire by calculating the amount consumed and the frequency of consumption.

2.3.3 Seasonal variation

Some species of kai awa, kai roto and kai moana are seasonal resources while others are open access. Seasonality is explained in historical literature recognising that tikanga and kawa was attuned and responsive to the life-cycle of the different species. Therefore, questions in the survey identified where possible seasonal patterns of contemporary gathering.

2.3.4 The impact of kai awa, kai roto and kai moana on whanau and hapu livelihoods

Arguably there is a need for a broader understanding of the importance of aquatic resources as a source of kai beyond the simplistic statements of mahinga kai that often accompanies ecologically based descriptions of aquatic ecosystems. The questionnaire sought to address this need by analysing the complex relationship that whanau have with waterbodies found in their takiwa.

2.3.5 Other

Other data gathered included:

1. demographic information, such as the prevalence of certain medical conditions, lifestyle factors including risk-related behaviours, and family history;

2. self-reported heath status using a generic, health-related quality of life questions;

3. kai gathering locations; and

4. perceptions held by whanau members about the importance of aquatic ecosystems and species, and their assessment of the health of these resources.

2.4 Qualitative methods

The qualitative methods used here address the first of the research objectives as stated in Section 1.3 above. Methods involved an introductory hui, a focus group session, follow-up interviews, informal discussions with many people and reviewing secondary data sources (documents).

2.4.1 Literature review

An examination of relevant literature was undertaken for five reasons

1. to provide a more comprehensive understanding of historical resource use and patterns of activity in the study community;

2. to gain an appreciation of the changes to the aquatic habitats over time, as perceived by participants;

3. to identify the changes over successive generations that have impacted on kai gathering behaviours;

4. to understand the aspirations of Te Runanga o Arowhenua to address issues of concern with respect to waterbodies; and

5. finally, to ascertain if and how agencies have responded to the stated aspirations of participants.

Qualitative data were collected from published and unpublished documents, from libraries, the Waitangi Tribunal (evidence to the Tribunal and reports from the Tribunal), statutory and iwi plans, and statutory planning documents. Internet searches also yielded further material.

2.4.2 Participatory methods

Before working with Te Runanga o Arowhenua, an introductory presentation was given at a monthly runanga meeting during which the participatory process was outlined. Two participatory methods were incorporated into the research: a focus group and interviews with key informants. At the start of all interactions (focus group and interviews) the roles and obligations of participants and researchers were discussed.

Focus group

A focus group was convened at Temuka in April 2008. Seven participants attended the focus group. The participants were engaged in a guided discussion lasting 1–1.5 hours. The focus group followed the framework of questions presented in Box 1. This second session focused on gaining a broad understanding of the spatial extent and description of aquatic resources from which kai awa, kai roto and kai moana were sourced, and the overall importance of each waterbody and species to whanau and hapu. Maps were used to record information about species, locations and other relevant information. Discussions of the focus group were taped.

In depth semi-structured interviews

In the weeks following the focus group meetings, follow-up interviews were conducted. The purpose of these interviews was to collect additional and more detailed data related to the location and types of kai collected and consumed, and factors that may have influenced gathering. Interviews also covered preparation technologies and processes, and specifics about consumption. The questions used for the focus group were also used to guide the interviews that probed more deeply into the personal experiences, thoughts and feelings of the individuals. The intention was to identify and explore the diversity and complexity of relationships and gain a comprehensive understanding of the changes to aquatic environments and the emergent issues seen as potentially impacting health and wellbeing as perceived by different individuals. Interviews were carried out with 10 individuals resident in South Canterbury. Each interviewee was identified by Te Runanga o Arowhenua.

BOX 1: QUESTIONS AT THE FOCUS GROUP & INTERVIEWS

Species of kai

- What (species of kai) did you gather when you were young?
- What places can you remember visiting to gather kai when you were growing up?
- Did you collect year round or seasonally?
- Can you recall any places that you were told not to go to for kai?
- Were there any times / occasions that you were unable to gather kai?
- How long did it take to gather the kai that you needed?
- What (species of) kai do you gather today? What places do you use today?
- Do you gather kai year round or is it seasonal?
- What events / conditions etc. stop you from gathering kai?
- How often would you or someone in your whanau go out to gather kai?
- How long does it take to gather kai compared to when you were younger?
- What species / sites have you lost over the years? When and why did you stop using them?

Behaviours with kai

- Is kai shared? With whom? Has this changed over your lifetime?
- How was kai prepared? Has this changed?
- What methods are used to collect kai? Has this changed?

Condition of kai

- What quantities were taken when you were younger? What quantities are taken today?
- What was the condition of the kai when you are younger? How does this compare with what is taken today?

Observed and known changes

- What changes to the experience of gathering kai h you observed? How has this affected you and your whanau? How have you adapted to these changes?
- What changes to the habitats have you observed and how have these affected you?
- What sort of things would you like to see happen in the aquatic environment you associate with and why?
- Are you happy with your current level of access to kai that you value? What are the main barriers you face today?

Wider benefits of gathering kai

- What do you like about being able to go and gather kai?
- When you gather kai are you with other whanau or hapu members?
- What rules or beliefs do you follow with respect to gathering kai?
- Do you feel any special attachment to the places from which you gather your kai?

Health risks

- Do you know of any health risks associated with gathering kai?
- If you were told not to gather kai from an area because of the health risks would you still gather from there?
- What type of information would you need to help you decide whether to gather kai from an unsafe site?

Informal interaction

It must be noted that the formal methods were augmented by many instances of informal discussion, as is the case in most qualitative research.

There were two principal outputs, the first being a map documenting the types, locations, and quantities of kai moana collected and consumed by those present. This was complemented by an analysis of discussions concerning when gathering was undertaken, and the processes used to prepare the kai.

2.5 Qualitative data analysis

In summary, informants were interviewed and interacted with in different forums, and their written documents (both historic and contemporary) and submissions provided further context for interpreting their values, practices, activities and concerns. Accessing multiple sources of data was one of the methodological tools employed to ensure the validity of data collected.

Lincoln and Guba (1985, 224-225) contend that the role of data analysis is "to 'make sense' of the data in ways that will, first, facilitate the continuing unfolding of the research, and second, lead to a maximal understanding of the phenomenon being studied in its context". There were two aspects to the data analysis:

1. firstly to identify sites and resources to be sampled for analysis of contaminant levels; and

2. secondly, the analysis involved identifying, sorting and grouping data from very detailed individual transcripts to identify key themes. The methods of data collection resulted in a considerable quantity of raw data being gathered, and data from a variety of sources had to be systematically analysed.

Data were broken into stand-alone pieces of information, coded and categorised. Categorisation of the data enabled similar themes to be distilled. Some of the themes had been established a priori based on key issues that had emerged while reading related literature and undertaking preliminary discussions when scoping the research topic and negotiating entry to the communities. The question of how to present the data collected from multiple (and mixed) methods was, at times, perplexing. Patterns began to emerge reflecting the diverse nature of the relationship each person had with aquatic habitats, and how and why they believe this relationship has changed over their lifetimes, i.e., how they perceived that these changes have made them feel and behave. Principal categories that were identified represent the headings under which the research findings are presented in sections 5 to 7.

Themes that were distilled from the documentary and interview data were compared with those that emerged from the survey by means of comparative analysis.

It is envisaged that summaries and drafts of this report and the composite report (with the results of the three hapu studies) will be presented and discussed at hui with members of each group.

Before concluding this section it is important to record that the lead researcher for this phase of the research is Ngai Tahu, trained as an environmental manager, employed to advocate in a variety of health and environmental fora for increased recognition of Ngai Tahu beliefs, values and practices, and has worked closely with Arowhenua for a number of years. This must be acknowledged, given the backgrounds from which the participants were selected. There was a possibility that participants gave answers that they thought "she wanted to hear". However by being aware of this possibility, by adopting a disciplined approach to ensure that throughout the data collection and analysis process there was constant referral to the research aims and objectives, and by utilising a range of methods to ensure the research was methodologically sound, the research findings presented in the next section of this report are a fair and accurate interpretation of the data collected.

2.6 Quantitative data analysis

The questionnaire was constructed on Survey Pro 5 (Apian Software Inc) and all data were entered into this programme. The results that are reported in section 5.2 and discussed in section 7 have been produced using the Survey Pro reporting functions. Microsoft Excel was used to construct two of the graphs.

2.7 Summary of methods applied

The methods applied to enable us to understand kai gathering behaviours over different time periods are set out in Table 1.

Table 1: Methods used during the course of the research.

PRE-EUROPEAN SETTLEMENT	19TH CENTURY POST EUROPEAN SETTLEMENT	20TH CENTURY UP TO 1970S – 1980S	PRESENT DAY
Manuscripts	Maori Land Court	Interviews	Interviews
Cultural maps	Land titles for		Review of
Historical texts	Evidence to Royal	Evidence to the	Kai Consumption
Evidence to Royal	Evidence to the Waitangi Tribunal	Photographs	
Evidence to the	Paintings		

3. Study Group

Te Runanga o Arowhenua

The legal identity of Te Runanga o Ngai Tahu is established in the Te Runanga o Ngai Tahu Act 1996. It is the tribal representative body of Ngai Tahu whanui. It is a body corporate, established on 24th April 1996 under section 16 of the Te Runanga o Ngai Tahu Act 1996. Pursuant to section 3 of that Act, "*the Act binds the Crown and every person (including any body politic or corporate) whose rights are affected by any provision of this Act"*.

The members of Te Runanga o Ngai Tahu are the 18 papatipu runanga, each of which is defined in the Act, as is the takiwa for each. Te Runanga o Arowhenua is one such runanga. This establishes who holds manawhenua rights over specific lands and waters within the rohe of Ngai Tahu. Te Runanga o Arowhenua has its offices at the marae at Arowhenua. As one of the 18 papatipu runanga, the takiwa of Te Runanga o Arowhenua, as defined in the Te Runanga o Ngai Tahu Act 1996, centres on Arowhenua and extends from Rakaia to Waitaki, and thence inland to Aoraki and the Main Divide. Figure 2 shows the papatipu marae at which the runanga office is located, while the rohe of Te Runanga o Arowhenua is shown in Figure 3.

Figure 2: The wharenui "Te Hapa o niu Tireni" at the marae at Arowhenua[2].

[2] Photo by Adrienne Rewi http://adriennerewiimagines.blogspot.com/2008_11_01_archive.html

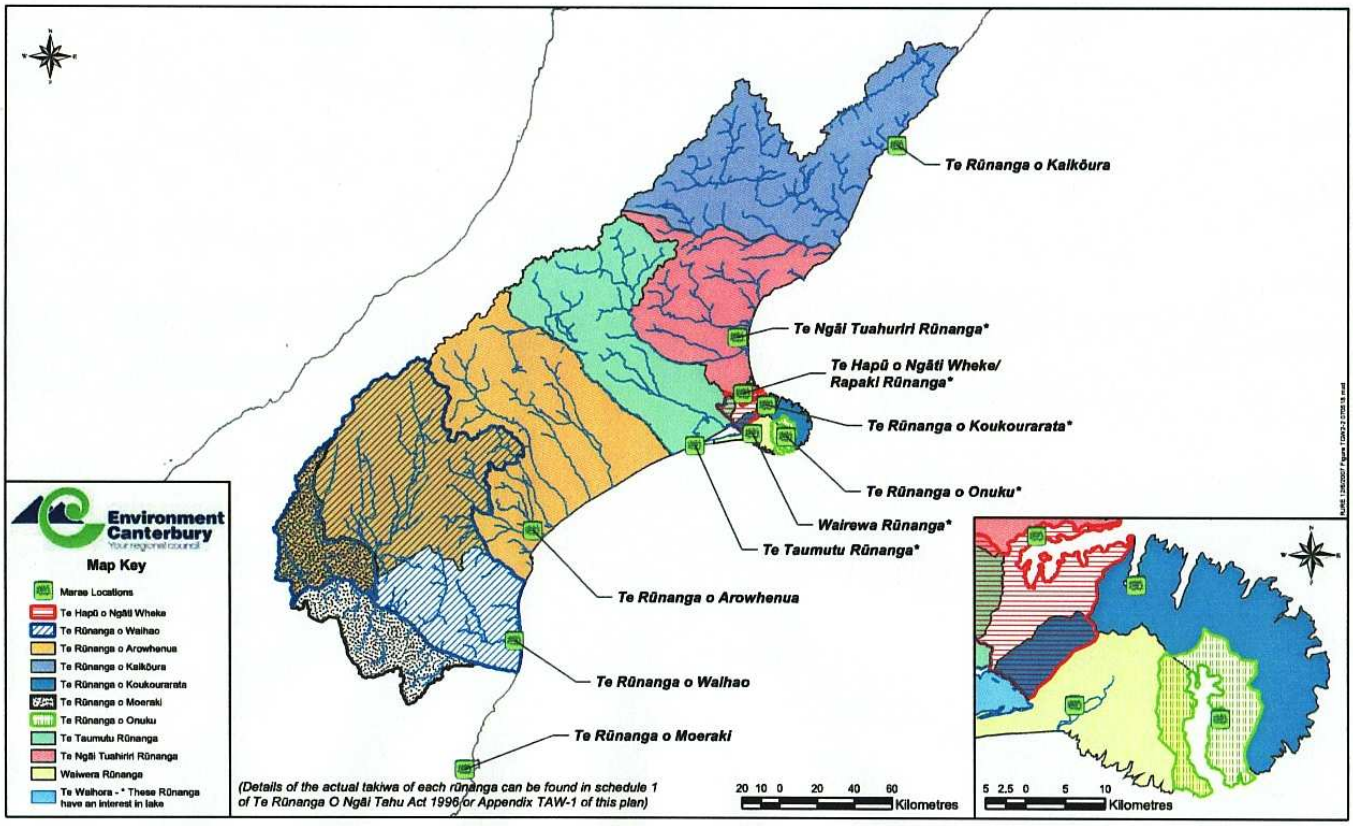


Figure 3: The takiwa of Te Runanga o Arowhenua (Source: Environment Canterbury Natural Resource Regional Plan http://www.ecan.govt.nz/our-responsibilities/regional-plans/nrrp/Pages/read-plan.aspx).

4. International developments relevant to the research

Consistent with the need for the present research to be examined in a context of international literature and academic thought, this section seeks to position the research design and data analyses within contemporary writings from four related areas:

- indigenous communities and participatory approaches to management;
- contemporary wellbeing research, and implications for this study;
- international observations of the impact of changing diets and effects of contaminants on health; and
- Maori conceptualisations of health and wellbeing.

4.1 Indigenous communities and their participation in management

This research sought to utilise participatory research methods. Participation is seen as a means of affording affected parties the opportunity to articulate their interests, enhancing the quality of information available to decision makers; enhancing the potential for support of decisions by enabling early and meaningful involvement; and affecting one's destiny as the opportunity to participate in decisions is a key element of self-empowerment and self-actualisation (Fenge, 1994). In the context of this research project, in addition to collecting environmental contamination data, the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana are examined, and empirical data collected for use by whanau and hapu.

Participatory approaches to environmental management received emphasis initially in the Brundtland report (WCED 1987) and in Agenda 21, at the 1992 ‘Earth Summit’. Perhaps the greatest significance of these fora lay in the acknowledgement that sustainable development would require new approaches to environmental management, and that effective environmental management would need to be differentially negotiated within individual states, even within individual communities. In effect, this research will also result in a range of cultural values and perspectives of particular aquatic locations being documented and available to each Maori community to inform local processes of management should they so choose.

Pimbert and Pretty (1997) contend that new partnerships and connectedness between different interests is required in environmental management and argue that

participatory processes must be locally grounded which will likely require different solutions for different places. This research will facilitate new participatory processes between environmental managers, public health managers, science agencies and Maori. Despite the increase in participatory initiatives, Pimbert and Pretty (1997) also warn that the call for peoples' participation risks becoming a catch-cry and part of the conventional rhetoric without delivering meaningful outcomes for participants. This warning reinforced the desire of the researchers to deliver a meaningful and effective process for application by Maori and outputs such as those listed in Figure 1 for use by Maori and resource managers.

The drive for greater participation has been paralleled by a concerted drive by indigenous communities to reassert their customary and Treaty rights to access and use land and water resources and greater recognition of the knowledge held within communities including indigenous communities (Western et al, 1994, Pinkerton 1989, 1992, Notzke 1994, Berkes and Folke 1998). Although a range of terms are used, often interchangeably, Berkes (1999) defines indigenous knowledge as that knowledge held by indigenous peoples and traditional ecological knowledge as a subset of that – a practical knowledge of species and beliefs regarding human interaction with the ecosystem. Menzies and Butler (2008) list the attributes of traditional ecological knowledge as cumulative (from long term intergenerational interaction), dynamic (informed by a customary lifestyle but not unchanging), providing a historical understanding of change, local, holistic (viewing all elements as interconnected), embedded (in a unique matrix of local, cultural, historical and traditional elements), moral and spiritual. In order to understand the changes to the diets of successive generations of Maori, the research team was dependent on key informants being experienced and knowledgeable (with indigenous knowledge and/or traditional ecological knowledge) about kai gathering.

Sadly, Maori, like other indigenous communities have witnessed the destruction of valued environments and their alienation from the resource bases upon which their cultures and identities are constructed (Berkes 1991, 1994, 1999). Documenting the changes that have been experienced in South Canterbury and the impacts on whanau and hapu, including a profound sense of loss, was therefore vital.

The growth of interest in the knowledge held by indigenous communities is related to the wider shift within resource management to an ecosystem based management approach (Menzies and Butler, 2003) and recognises that indigenous communities understand the way species interrelate and how ecosystems work as a whole. It recognises that indigenous communities have a well developed understanding of the local environment and their own impacts on local ecosystems. The data collected via the interviews and questionnaire confirmed the proposition of Berkes (1999, page 33) that the "use of traditional knowledge may benefit development by providing more

realistic evaluations of local need, environmental constraints and natural resource production systems".

Initiatives involving the incorporation and/or application of indigenous knowledge are emerging around the world as resource managers seek to engage with indigenous communities. New Zealand has also experienced the drive for greater participation, including greater recognition of the beliefs, values and practices of Maori. In 1991, the Resource Management Act 1991 became the governing legislation for resource use in New Zealand (Davis and Threfall 2006). Two sections are of particular relevance.

Section 6 requires that anyone exercising functions and powers under the Resource Management Act 1991 recognise and provide for matters of national importance including "the relationship of Maori and their cultures and traditions with their ancestral lands, water, sites, *wahi tapu* and other *taonga*" (section 6(e)). Gathering from tribal lands and waters, species that are often accorded the status of "taonga", clearly falls within the gambit of section 6(e) and is thus a matter of national importance.

Pursuant to section 7(a) decision-makers are required to have particular regard to *kaitiakitanga*. The Act presently defines kaitiakitanga as:

> *The exercise of guardianship by the tangata whenua of an area in accordance with tikanga Maori in relation to natural and physical resources; and includes the ethic of stewardship based on the nature of the resource itself.*

The responsibilities of Tangata Kaitiaki are to protect the integrity of resources (including the kai species identified by informants). This requires Maori to focus on long term environmental results, which are likely to include healthy ecosystems with abundant populations of valued kai species that are able to sustain cultural uses well into the future. Despite these encouraging and potentially enabling provisions, often there is little guidance given to managers and regional bodies seeking to meet the obligations to indigenous communities (a challenge Maori confront in New Zealand). This research seeks to produce outputs that will guide both Maori and non-Maori resource managers.

4.2 Contemporary wellbeing research: implications for this study

For indigenous communities food is not just a resource for sustenance as many might understand it in western contexts (Slocum 2007). Rather, Panelli and Tipa (2007, 2008) argue, that food needs to be understood in a wider cultural context that interweaves complex indigenous cultural and environmental relations.

Panelli and Tipa (2007, 2008) contend that to identify these relationships primarily by a particular bio-physical character (e.g., forests, coasts and waterways) misses the range of spiritual, physical, social, material, cultural, economic and political relationships that might be involved in any one case. The complexity of these relationships must be appreciated before the significance of an 'individual' phenomenon or activity (such as food or food gathering) might even begin to be approached (let alone the cultural or health implications of such things). They further contend that to consider kai gathering without this contextual understanding would diminish its cultural value and the rich dimensions that underpin whanau and hapu experiences of identity and well-being. The results of the Kai Consumption Survey reported in subsequent sections of this report support the proposition that individual experiences of interviewees vary as lives are influenced by a complex combination of: cultural beliefs, values and uses; a history of colonization, loss of lands, alienation from their lands, waters and resources; and contemporary interactions with a dominant non-Maori world that is based primarily on capitalist, western values (Panelli and Tipa, 2008). The range of perceptions, preferences and the experiences of members of Te Runanga o Arowhenua that emerged from the analysis of data collected for the present research are set out in sections 5 – 7 of this report.

Indigenous communities have traditionally been resource users and developers (O'Regan 1984, Notzke 1994). They used natural and physical resources for subsistence (physical survival) and sustenance (spiritual survival). Internationally there are calls to recognize and protect cultural knowledge and practices that are 'fundamental for food security and well being' (FAO 2007). Gombay (2005: 418) explains the significance of this stance, and when describing the Inuit argues that when they:

> *hunt, fish, or gather food the material and immaterial worlds blend together, with layer upon layer of meaning and understanding. The getting of country foods is about understanding the land in which one lives. It is about building an awareness and knowledge of one's place in the natural world ….*

The gathering, exchange and consumption of kai are also significant cultural activities for Maori. Complex associations with the environment and mahinga kai have developed over centuries and include social, economic, psychological, spiritual and physical dimensions that are an intrinsic part of health and well-being of whanau members. Diversity is wide (as evidenced by the individual variation from the survey results) but this is considered acceptable within whanau and hapu. The data collected helps explain how sourcing kai from lands and waters reaffirms firstly, connectedness with the lands and waters to which one has whakapapa, and secondly ensures continuity of practices initiated and valued by tupuna. In the Ngai Tahu context, mahinga kai practices also enable social and environmental responsibilities to be

fulfilled. To be denied the opportunity to manaaki visitors to one's home and marae would have consequential adverse effects on the health and well-being of Maori – a point that may be experienced beyond the individual and whanau level.

4.3 Maori conceptualisations of health and wellbeing

Durie (1994) introduced *Te Whare Tapa Whā* - a four sided house - or the four cornerstones of health; these being: *hinengaro* (mental well-being), *wairua* (spiritual well-being), *whanau* (family well-being) and *tinana* (physical well-being) which was subsequently adopted by the Ministry of Health (2006). Durie (2004) then proposed a second conceptualisation, *Te Pae Mahutonga*, which he contends represents the fundamental components of health promotion - *Mauriora, Waiora, Toiora* and *Te Oranga*. He explains that: *Mauriora* is dependent on a secure cultural identity; *Waiora* refers to healthy air, land and water environments which requires a balance between use and development and protection; *Toiora* focuses on personal behaviours and responsiblities; and *Te Oranga* recognises that health promotion (in particular increasing well-being) requires increased participation by Maori in societal affairs.

Another conceptualsation, by Pere (1997) emphasises reciprocity and interconnection between individual selves and wider social interests. In this sense, each experience of well-being would vary from place to place reflecting *whenua* (earth), *turangawaewae* (standplace), *whanaungatanga* (kinship), *whanau* (family), *wairua* (spirit), *hinengaro* (mind, heart), *whatumanawa* (feelings) and *tinana* (body). This conceptualisation by Pere helps explain connections between specific understandings of *whenua* and the social and cultural relations developed in particular places.

Panelli and Tipa (2008) explain how many Maori express a strong affinity for the earth and adhere to basic principles regarding their relationship with other aspects of creation and quote Crengle (2002) who explains all parts of the environment are related to one another and exist within a mutually inter-dependent whole. Deriving economic or social benefit from resource utilisation (recognised as contributors to wellbeing), must be carefully balanced.

Initiation of the current research programme and exploring the contribution of kai gathering to health and wellbeing is predicated on the belief that understandings of health and well-being can be enhanced by explicit conceptualisations that align spiritual, social and cultural elements in connection with bio- physical bases.

4.4 Effects of contaminants on health

While some agencies and researchers contend that people everywhere are exposed to chemical contaminants in the environment, international studies confirm that the majority of exposure to contaminants comes from food, with the consumption of contaminated fish identified as the largest single source of exposure in Canada (Health Canada 1997). Of concern, fish constitutes a significant dietary source of protein for many populations worldwide, especially indigenous communities.

Traditionally, the diet of many indigenous communities (including Maori) consisted of fish, game, waterfowl, and plants sourced from local lands, waters and coasts. Contemporary diets, in contrast, are likely to be a combination of traditional food items and more easily accessed commodity or convenience foods. Despite the change to convenience foods, traditional foods continue to underpin cultural identity for many indigenous communities. Delormier and Kuhnlein (1999) explain how changes experienced by Eastern James Bay Cree have affected diet, traditional food use, and nutrition. They contend that the reduced use of traditional food by younger generations, changes in fish consumption as a result of contamination, and increased incidence of obesity, diabetes, and cardiovascular disease within communities, represent particular socio-cultural concerns. Exploration of these issues and the longer term impacts has necessitated examination of the current diet and food consumption patterns of the Cree. The nature and extent of the risk that Maori confront in New Zealand is unknown but this research attempts to assess the risk.

If food is a major route of human exposure to many persistent toxic environmental contaminants the present research hypothesised that the consumption rates of aquatic species by Maori could represent a significant risk of exposure given their potential higher rates of consumption of these foods. The information gathered through the interviews and the questionnaire therefore had to enable the research team to establish whether there were any correlations between the contaminant levels measured in the participants' tissues (hair) (a separate component) and the fish or shellfish species they consumed in the past year. While such a relationship could not be considered as defining a direct cause:effect relationship, it would increase our understanding of the possible exposure risk to tangata whenua. We have also developed a model of potential contaminant accumulation pathways between participants and the kai they consume and calculation of relative risk, based on measured contaminant levels in kai species, their associated environments and consumers. Furthermore, the data had to enable the research team to assess the levels of contaminants in the respective fish and shellfish species consumed, by identifying important species and harvesting locations. These data were subsequently used to develop a sampling plan for kai species and associated environmental parameters. The results of these strands of research are to be presented elsewhere.

In risk management, the focus is on ensuring that mitigation strategies are culturally appropriate yet rarely are Maori perspectives or knowledge explicitly included in determining the hazards or health outcomes to be considered in the risk assessment. In the absence of explicit procedures to apply health risk assessment in Maori communities, the data derived from the questionnaires and interviews will contribute to the development of a health risk assessment model. Again using data gathered from this stage, we will develop Maori-focused guidelines with respect to the consumption of wild sourced kai and will also explore the appropriateness of existing information dissemination tools for effectively communicating risk.

5. Research results

In this section of the report we start by providing a description of the mahinga kai practices of whanau and hapu across South Canterbury prior to European settlement before profiling the present day behaviours of whanau members and highlighting changes from traditional lifestyles. Although challenging, we also seek to identify causes for the changes. The information relating to traditional practices is extracted from secondary data sources (including tribal manuscripts). Interviews with whanau members and the Kai Consumption Survey provided the data from which the contemporary profile was constructed.

5.1 Traditional patterns of gathering

From the oral histories of Ngai Tahu and written manuscripts, descriptions of a stable mahinga kai based lifestyle emerges. Evison (1993) describes how the great number of plants, birds, and fish that comprised the food sources of Ngai Tahu assured always that somewhere, something was available to eat. An outstanding characteristic was the sequential utilisation of a variety of natural resources from widely dispersed localities mirroring the cycles of rivers and species (Dacker 1990, Anderson 1988, 1998). This pattern of resource use shaped an itinerant lifestyle where mobility was pronounced and essential.

Movement and an understanding of the resources available over a wide territory were therefore crucial for sustaining the livelihoods of Ngai Tahu whanui prior to European settlement (WT[3], 1991, J10:99). Anderson (1998) described how the population dispersed during late spring to autumn to inland regions and retreated to long term settlements (typically nearer the coast) in winter and early spring.

Various resources which were seasonably abundant would be preserved and the food taken back to these more permanent settlements (WT, 1991 - H1:76–77). Other purposeful travels included inland hikoi to collect pounamu and the annual migration south to the Titi Islands in autumn to obtain titi (mutton birds). Mahinga kai was the basis of the Ngai Tahu economy and culture before contact with Europeans.

European settlement inevitably impacted Ngai Tahu mahinga kai resources and patterns of activity. Evidence given by Ngai Tahu whanui to Commissioner Mackay in 1891, who convened one of the Royal Commissions, stressed the loss of mahinga kai and the consequent adverse impacts on the lifestyles of whanau and hapu. While

[3] "WT" is used as an abbreviation of the Waitangi Tribunal.

fishing and eeling were still available to whanau and hapu, eventually these sources of food were also at risk (WT 1991, F11:51).

In this chapter we distinguish kai gathering in four time periods:

- pre European settlement;
- post European settlement – in mid to late nineteenth century;
- twentieth century up until the 1970s and 1980s; and
- the present (results of the present study).

5.1.1 Pre-European settlement - Traditional settlements and patterns of resource use

Ngai Tahu place names provide insight into the use of lands and waters, and the resources sourced from them. Individual Ngai Tahu within their living memory would have a mental map of important places that supported their itinerant lifestyle, including camping places, settlements, and the different resources that could be obtained and utilised - all held in memory like whakapapa, where the sequence and significance of every place was known (Kruptnik, 2002). The writings of ethnographers, such as Beattie, yield hundreds of place names[4]. Sadly, over time the location of many has been lost.

Figure 4 illustrates some of many place names found across South Canterbury and confirms widespread use of the region by Ngai Tahu. Each of the sites in Figure 4 represents a valued mahinga kai site that was instrumental in providing the resources essential to sustaining whanau and hapu. A summary of the mahinga kai sourced from these sites are shown in Figure 5 with a more detailed list of the 38 species obtained from these sites across South Canterbury presented in Table 2.

[4] Beattie recorded over 1400 place names for Canterbury. Other ethnographers obtained more.

Table 2: Species were traditionally gathered from across South Canterbury.

SPECIES				
Eels	Smelt	Flounder	Potato	Turnip
Rats	Seals	Whitebait	Whale	Aruhe
Sea nuts	Kanakana	Patete	Kauru	Flax honey
Flax	Panako	Kumara	Shark	Groper
Shellfish	Paua	Sea urchins	Tutu	Kokopu
Koareare	Weka	Kahawai	Cabbage	Kokopara
Kanaka	Pakihi	Minnows	Taramea	Birds
Mullet	Puha	Watercress		

The 1880 map and accompanying manuscript, commonly referred to as the "Taiaroa papers" by Ngai Tahu, represent a highly valued "cultural map". It was an initiative by kaumatua from neighbouring hapu and facilitated by H.K. Taiaroa, to map their collective territory, their mahinga kai interests and values associated with particular sites[5]. These records allow a more complete examination of the system of food gathering system within the Canterbury and Otago regions.

[5] Nearly 1400 places across Canterbury and Otago were written down and mapped which coincided with the Smith Nairn Commission enquiry (1881).

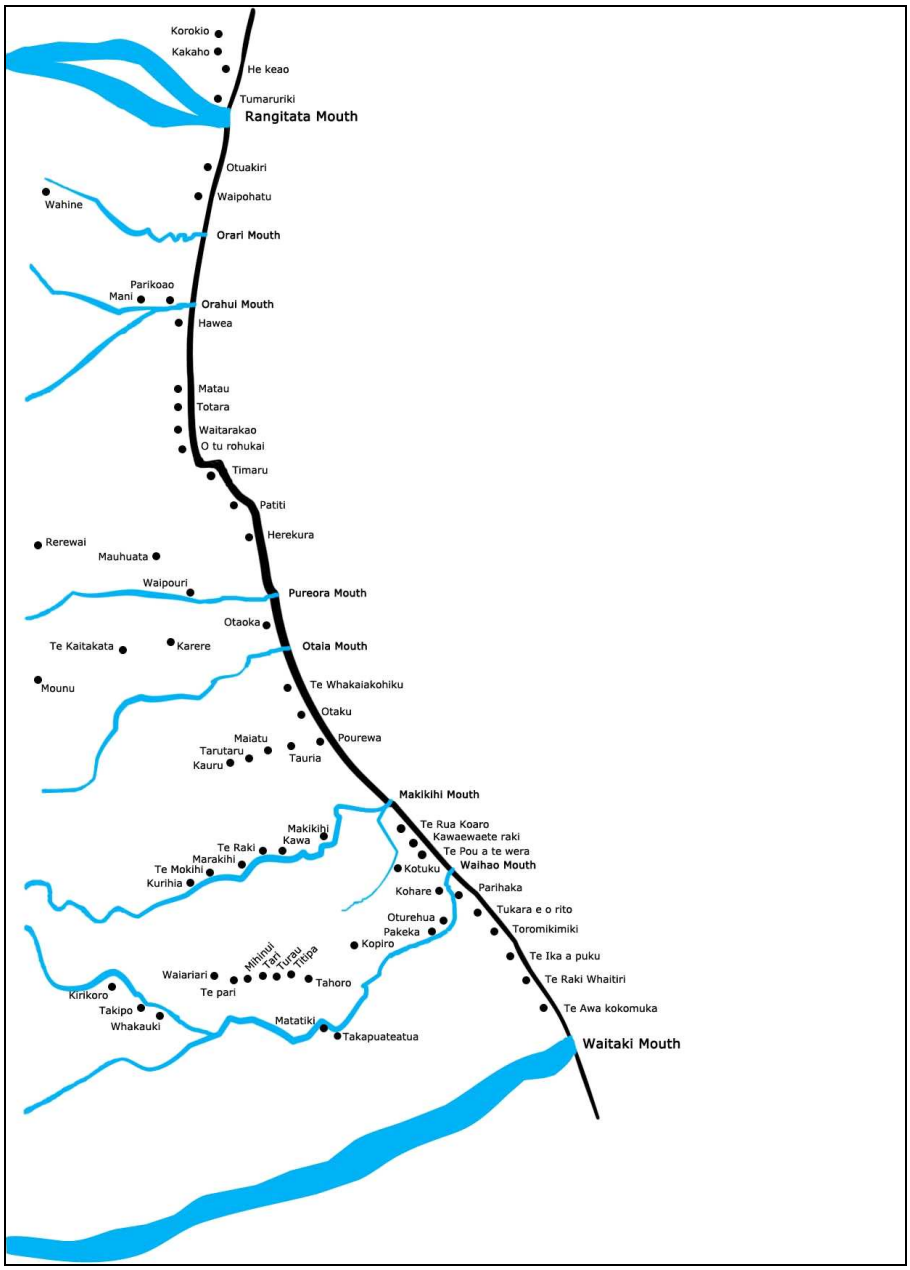


Figure 4: Traditional place names across South Canterbury.

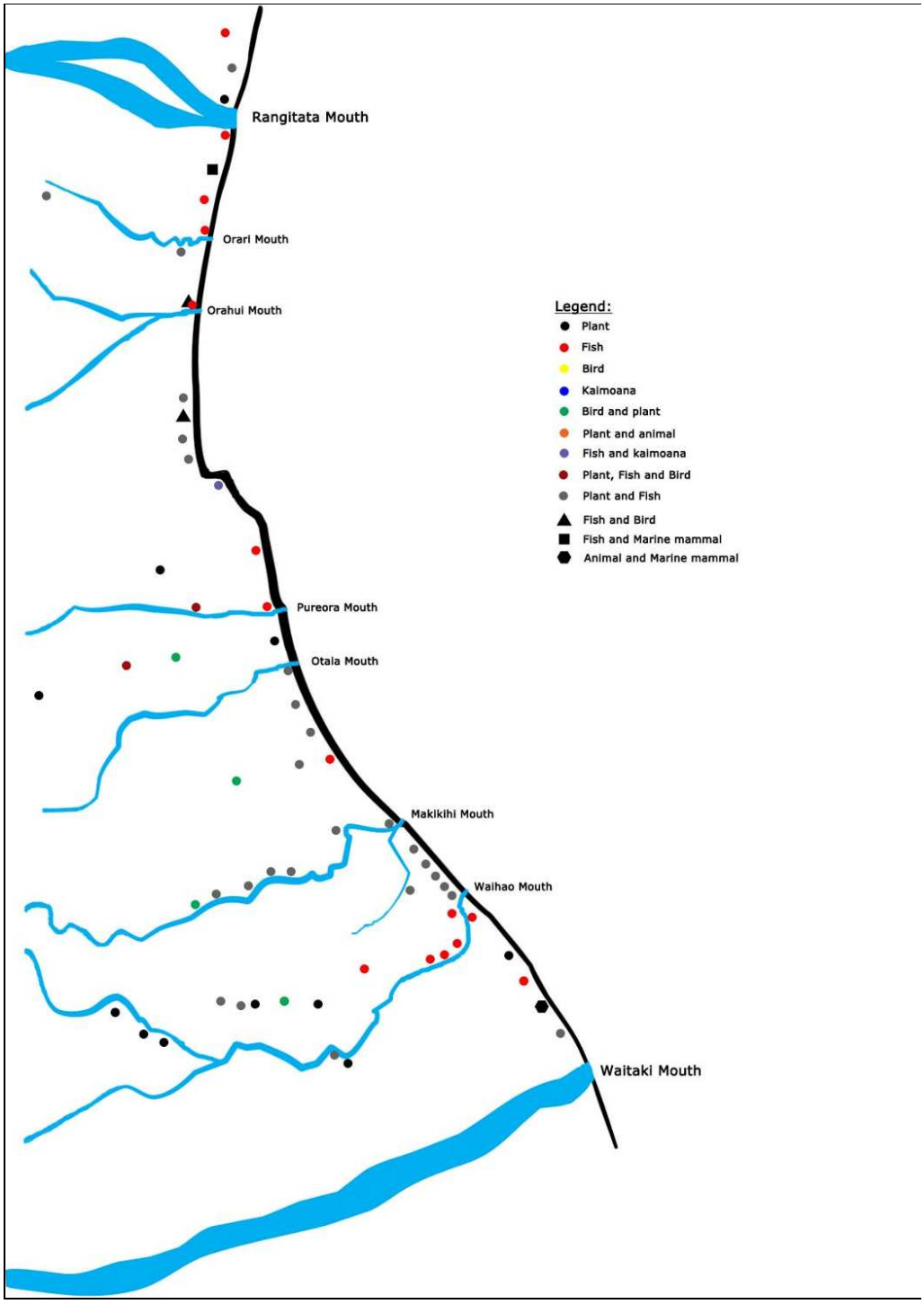


Figure 5: A few of the mahinga kai sites found across South Canterbury. (Please note that there were considerably more sites than those shown above. To avoid congestion of the map and to preserve the location of some sites, the names and uses of sites have been withheld).

As Table 2 shows, thirty eight different foods and materials were gathered from more than 100 sites across South Canterbury (between the Waitaki and the Rakaia and extending inland to the main divide). Table 3 shows the ten most commonly gathered species.

Table 3: Percentage of sites from which species were gathered from across South Canterbury.

SPECIES	PERCENTAGE OF
Eels	72%
Kauru (extract from the cabbage tree)	24%
Minnows	19%
Aruhe (bracken fern)	19%
Turnip / potato	13%
Whitebait	11%
Flax	11%
Koareare (root of the bulrush)	9%
Weka	8%
Kokopu / kokopara	8%

A distinctive social order emerged in the south shaped by the colder climate that dictated an itinerant lifestyle. Each whanau and hapu had rights to particular river reaches for fishing and defined lands for gathering wildlife and plants (Williams 2004, Anderson 1998). These areas were known as *rauiri* (preserves) and defined by *wakawaka* (boundaries) (Beattie 1939, Best 1942). It must be acknowledged however that traditionally rights had to be maintained through continual usage. Through an annual cycle of fishing, gathering and hunting, whanau and hapu "kept the fires burning" in many locations across a large tract of the South Island. Intermarriage between hapu and subsequent rights of inheritance and succession mean that for many Ngai Tahu today they now hold rights to lands across much of the southern region.

Historically enough kai was gathered to feed the immediate and extended whanau with some remaining to donate or trade. Mahinga kai meant survival. Sharing with those unable to gather for themselves is a practical expression of *whanaungatanga*. Concepts of *tapu* and *noa* shaped a management system that limited the scale of gathering (Anderson 1998, Williams 2004), but mistakes would have undoubtedly led to waste, overexploitation, and the collapse of some food sources. Knowledge of such mistakes passed from generation to generation in the form of *tikanga* and *kawa* (correct protocols and practices) the function of which was to prevent a repeat (Williams 2004).

Mahinga kai was the basis of an economy based "principally on the giving of gifts upon which were attached the obligations of reciprocity" (Williams 2004,p 88). By the time of European settlement Ngai Tahu had built a robust economy and a rich culture adapted to the local climate, resource base, and landscape (Evison 1993). Gathering was a social activity as well as an economic one. The extensive network of rivers, lakes, mountain ridges and valleys provided avenues of travel essential to Ngai Tahu social and economic relations. South Canterbury, in the middle of Te Wai Pounamu, provided links to the inland areas of the Mackenzie Valley, to the Upper Clutha and to Te Tai Poutini. Hapu and inter-hapu ties and alliances, the backbone of Ngai Tahu social and economic exchange systems, depended upon the free and easy movement of people within and beyond South Canterbury.

5.1.2 Post-European Settlement: Reserves and fishing easements awarded in 1848 and 1868

> *"Even after the land purchases, Ngai Tahu continued to gather their traditional food, not only from areas near their settlements but also in journeys to far places. Despite the development of pastoral farming by the new settlers many Ngai Tahu continued to rely on their traditional hunting grounds for their existence".* (Waitangi Tribunal 1991)

With promises of government payments for the purchase of lands, the retention of fishing and hunting rights, and allocation of a series of reserves, Ngai Tahu were persuaded to surrender title to significant tracts of land and the pattern of rauiri and wakawaka was disrupted. According to the Government's policy of setting aside reserves, small tracts of land were identified as reserves to protect Ngai Tahu from settlers. In practical terms however reserves enabled all lands beyond the boundaries of reserves to be opened for settlement.

Many of the reserves and fishing easements (listed in Tables 4 and 5 that were granted to enable the continuation of a food gathering lifestyle) can be traced back to Crown Grants to Ngai Tahu whanui which stem from the Southern Purchase Deeds negotiated between 1844 and 1857. As an unanticipated consequence of the sale and transition to newly acquired reserves, Ngai Tahu were no longer free to migrate seasonally across the plains of Canterbury.

As the lands along lowland catchments of South Canterbury were taken over by settlers, fences curtailed gathering of kai from many valued sites. Although Ngai Tahu were determined to maintain their relationship with mahinga kai, this period of land alienation and substitution with reserves and easements marked the initial transition from a traditional diet and a lifestyle dictated by resource utilisation.

Table 4: A list of some of the native reserves in the province of Canterbury (Mackay, undated).

Reserve Name	Acres	Interest
Section 12,373 Waikawa	150	
Kaikanui	4	Reserved in 1848 by Mantell in terms of Kemps Purchase
Arowhenua	376	Reserved in 1848 by Mantell in terms of Kemps Purchase
Waipopo	187	Reserved in 1848 by Mantell in terms of Kemps Purchase
Te Upoko o Rakaitaweka	20	Reserved in 1848 by Mantell in terms of Kemps Purchase
Tauhinu	23	Reserved in 1848 by Mantell in terms of Kemps Purchase
Waimatemate	40	Reserved by the Canterbury Association
Waikawa	138	Selected in lieu of reserve at Hakataramea
Rakipaua	20	Reserved in 1848 by Mantell in terms of Kemps Purchase
Arowhenua	2	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Arowhenua	150	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Arowhenua	30	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Arowhenua	20	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Waimatemate	500	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Waimatemate	30	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Waimatemate	10	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Waimatemate	20	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Taumutu	63	Reserved by the Governor General to supplement land at Taumutu
Kapunatiki	600	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Orari River (north)	10	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Orari River (south)	20	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Waitangi	10	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848

Because this research focuses on aquatic ecosystems, Table 5 extracts from Table 4 the reserves relating to the Fenton Orders of 1868 and highlights their relationship to

aquatic ecosystems. These reserves and easements are important as even today they continue to sustain the gathering of freshwater aquatic species. However access to and the ability to gather many of the terrestrial species listed in Table 1 was denied from the mid nineteenth century.

Table 5: A Summary of Fenton Orders of 1868 resulting from Kemps Deed of 1848[6].

Location	Association with water
450 acres Waitangi District (Waihao Maori Reserve)	
30 acres District (Glenavy sections)	
10 acres Waitangi District – near Wainono (Te Houiri Maori reserve)	Fishing easement - Near Wainono Lagoon. Bounded on the westward by a small lagoon.
20 acres Waitangi District (Puhakati Maori Reserve)	Fishing easement
10 acres Waitangi District Awakokomuka Maori Reserve	Fishing easement (now inaccessible)
600 acres Timaru District – Kapunatiki	The southern boundary skirting the edge of the swamp
10 acres Timaru District – south bank Orari River	Fishing easement - Having 10 chains frontage to the south bank of the river
20 acres Timaru District – north bank Orari River	Fishing easement - Having 10 chains frontage to the north bank of the river (has now disappeared)
2 acres	Fishing easement - A square block of land from the stream from Waitarakao Lagoon (near Washdyke)
150 acres Timaru District – Kapunatiki Creek	Is now gone – disappeared.
72 acres	Part of island near Harereatou Lagoon in the mouth of the Umukaha River – this is now washed away.
20 acres Timaru District – Orakipaoa (to include old pa)	

Figure 6 illustrates the location of the fishing easements in Canterbury, including the five in the Arowhenua district which are highlighted.

[6] This information was sourced from Taylor (1950) and from descriptions found in a report titled *Research into Maori Fishing Reserves: Establishment of Rights – Objections and Complaints from 1840"*. The senior author was given a copy of the report by Kelly Davis.

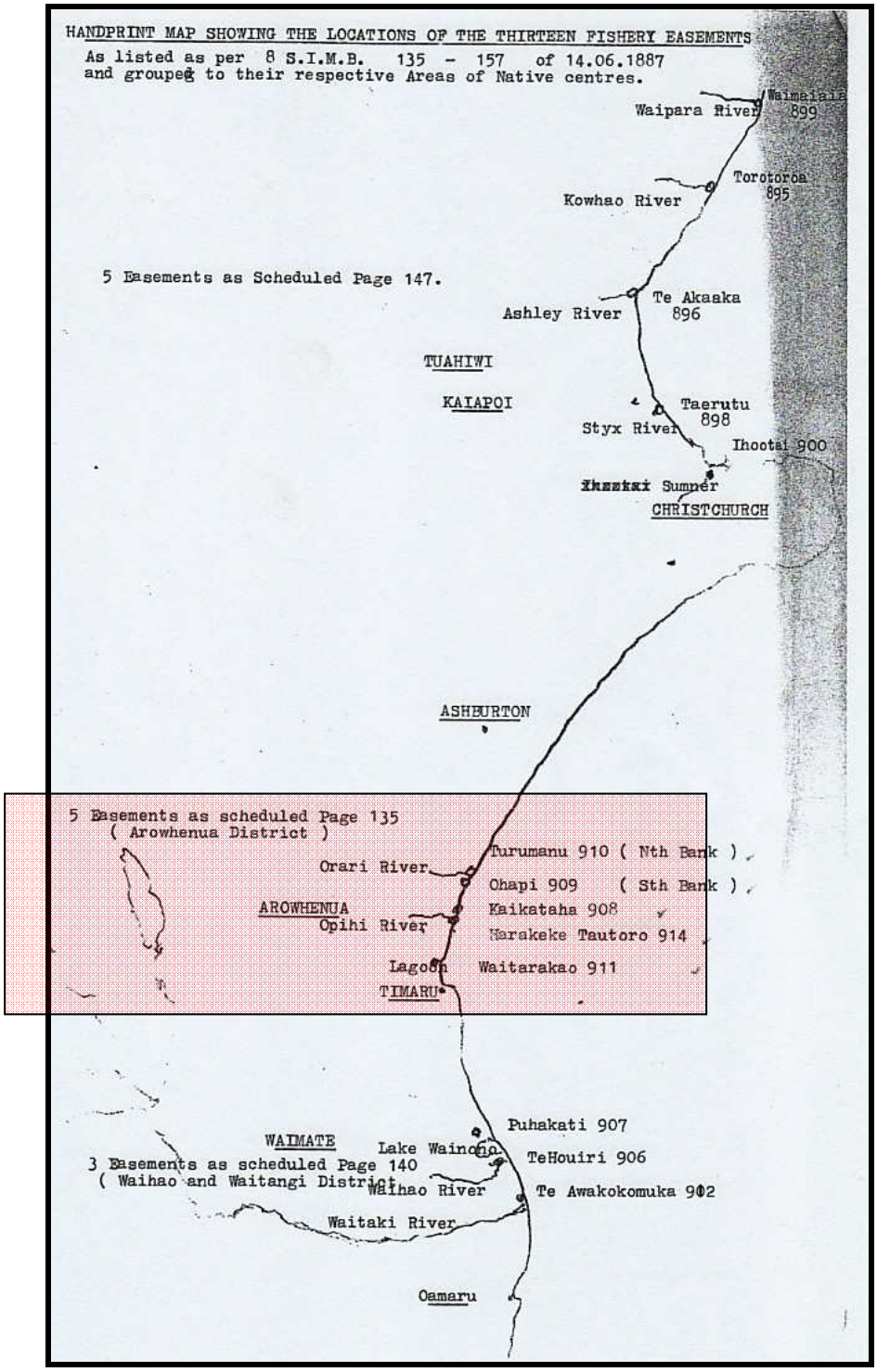


Figure 6: Location of fishing easements in Canterbury.

Figure 7: Coastline near Timaru – September 1874 (Australian National Library).

Figure 8: Washdyke Lagoon – near Timaru, October 1874. Thirty acres of this has now gone (Australian National Library).

Figure 9: Washdyke Lagoon 1874 (Australian National Library).

5.1.3 Comments presented in support of the Ngai Tahu Claim to the Waitangi Tribunal in 1989 – 1990.

Members of Te Runanga o Arowhenua presented evidence to the Waitangi Tribunal in 1989-90 in support of the Ngai Tahu Claim (Wai 27). They explained how all the lakes and rivers in the South Canterbury area that were once a source of food had been modified and adversely impacted since European settlement. These statements to the Tribunal provide insights into the changing mahinga kai practices experienced by whanau living across South Canterbury, and importantly with respect to this research, identify emerging contamination concerns.

Kai gathering

- Mr Jack Reihana recalled camping for a week or more to catch and preserve eels at Lake Wainono and spoke of an old lady bringing home large quantities of dried eels from Waitarokaoa (Washdyke) (WT 1991, H10:2).

- Mr William Torepe reviewed past and [then] present availability of mahinga kai from Waitaki to Rakaia (H10:4) which included kai such as tuna, fish, watercress, wild fowl and acclimatised species in the Opihi, Waihi and Temuka Rivers, Milford Lagoon, Hae Hae Te Moana, Kakahu, the beach in the vicinity of Pareora River, and Waimate Creek. He then proceeded to comment on the "diminution of Maori kai" and how this has affected their ability to manaaki guests on the marae (WT 1991, H10:8).

- Mr Kelvin Anglem spoke of the past abundance of eels in the Opihi which were preserved or bartered. He also commented on the [then] depletion of tuna, whitebait and kanakana (WT 1991, H10:19). He lamented the shortage of eels in the Opihi River which once supplied in one night their whole winter's supply.

- Mr Kelvyn Davis-Te Maire stressed that the areas were not merely important for mahinga kai but were also areas of historical importance (WT 1991, H10:33–34).

- Te Ao Hurae Waaka, related the past history of the district and how the whole area from the eastern seashore to the main divide had been accessed by Arowhenua (WT 1991, H10:47; H47.1).

The impacts associated with introducing exotic species

Although Ngai Tahu had repeatedly voiced their concerns at the impact of introduced aquatic species, the general consensus of those presenting scientific evidence to the Tribunal was that the decline in native species was due to changing land use rather than from competition with exotic fish. Mr Davis-Te Maire was critical of the management of water fowl by the Acclimatisation Society (now restructured as the Fish and Game Council) (WT 1991, H10:33). Mr Anglem described eel drives designed to protect young trout, when hundreds of eels were slashed and killed with lengths of hoop iron and allowed to flood down the river or left to rot on the banks (WT 1991, H10:23).

Water extraction

Mr Torepe spoke of the lack of water in the Opihi River - an important mahinga kai location (WT 1991, H10:2). He attributed this to the issuance of permits by the Regional Water Board to allow the Timaru City Council to draw off water for domestic supply and permits for farmers to take water for irrigation. He observed that this had the effect of reducing flows in the lower Opihi River, leaving it dry for at least three months of the summer with the consequent effect on kai resources. He claimed that the majority of streams and creeks within Canterbury had been transformed into flood channels. He believed the supply of fish in the Opihi River was now depleted as a result of water reduction.

The Opihi River has been affected by flow reductions since about 1936, when the Levels Plain Irrigation Scheme began operation. These reductions created a number of problems for fish stocks.

- Compounding the impact of low flows, another witness, Mr Sagar, contended that changes in land use within the catchment, and flood protection works had all contributed to modifying the river system.

- Mr Little stated that not only does water extraction lead to a loss of fisheries habitat, migration routes and cover, it also results in changes in temperature, increased weed growth and possibly destruction of the river (WT 1991, P15a:10).

It was thought that modest increases in the flow of the Opihi would improve the fisheries values of the river. A minimum was instituted following commissioning of the Opuha Irrigation Scheme. Although dewatering is not longer a problem, a number of issues persist.

The demands for water from so many uses, coupled with river re-alignment, plus land loss when floods washed away acres of reserve land, and the drainage of creeks and swamps, all served to adversely affect Ngai Tahu's access to mahinga kai. It also contributed to another serious consequence – the problem of pollution.

Pollution

Mr Anglem identified factors such as sewerage disposal, wool scour effluent, dairy factory discharge, aerial spraying and topdressing, farm waste and irrigation diversion which had reduced the Opihi and its estuary from an important breeding and feeding ground for migratory birds and fish into something unfit for humans and animals to swim in, concluding:

> *I am glad my Tupuna cannot stand on the banks of the Opihi and see what I have stood back and allowed to happen to their river.* (WT 1991, H10:24)

Mr Torepe (17.2.5) said that dirty and greasy effluent was discharged into the Waihi River at Winchester (WT 1991, H10:2). He also added that the beach in the vicinity of the Pareora River may be polluted by freezing works discharge of untreated remains (see Figure 10 below).

Figure 10: Opened in 1904, the Pareora Freezing Works is one of two meat-processing plants in the region – Smithfield at Washdyke is the other. The red hue in the sea is effluent from the works. (Photo source: www.teara.govt.nz/files/p11486gns.jpg).

A report from the water resources manager of the South Canterbury Regional Water Board (WT 1991, H49) dated 8 April 1988, describes the water quality in the Waihou River, Lake Wainono, Opihi River, Temuka River, Orari River, Rangitata River and the coastal zone. The problem of eutrophication within the Waihi–Temuka River system and the lower Orari River was highlighted. The report explained that eutrophication results mainly from the introduction of nitrogen and phosphorus. Fertiliser on farmland was seen as the major source of nitrogen. Domestic sewerage was believed to be the major source of phosphorous which it was thought could be addressed by upgrading the oxidation ponds at the Geraldine and Temuka treatment plants.

The witnesses to the Waitangi Tribunal concluded that there were serious water quality problems in the Temuka River and indeed they predicted problems in other rivers in the future. The members of the Waitangi Tribunal concluded after viewing the lower Opihi River that diverse sources of nutrients from adjacent farmland and the shortage of water in the river generally have changed the structure of the river with a serious effect on the mahinga kai qualities.

Without doubt, social and economic shifts during the last 160 years resulted in major changes in the relationship between Ngai Tahu and mahinga kai. The cumulative effect of settlement, an industrial economy that saw newly arrived settlers exploit all economic resources, plus the plethora of regulatory systems instituted by government, changed both the circumstances and practice of mahinga kai, with both natural environments and resources impacted, and consequently the knowledge generating processes associated with kai gathering being changed or alienated from many Ngai Tahu.

5.2 Contemporary patterns of gathering

This section draws on the data from the Kai Consumption Survey to describe contemporary kai gathering practices and behaviours. Where appropriate quotations extracted from the interviews with whanau members are added.

5.2.1 Background of participants

All participants were Maori residing in the South Canterbury region.

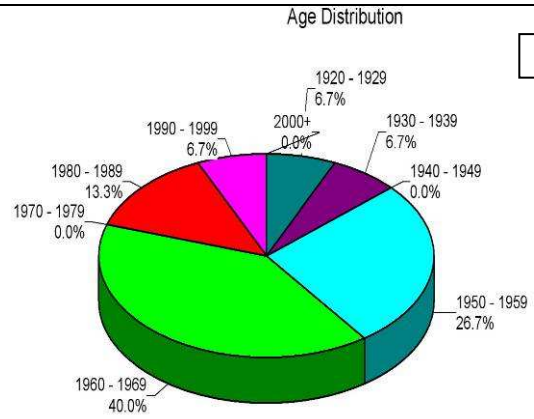


Figure 11

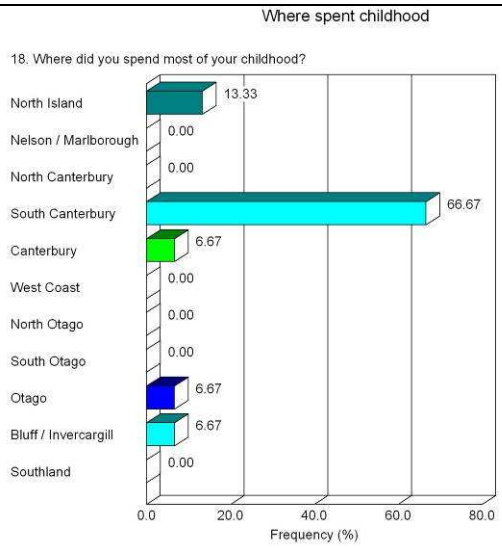


Figure 12

Only a limited number of participants have completed the survey (Figure 11):

- 1 is aged 10-19 years
- 2 are aged 20-29 years
- 6 are aged 40-49 years
- 4 are aged 50-59 years
- 1 was aged 70-79 years
- 1 was aged 80-89 years

Of the 15 participants 2 were female and 13 were male.

Two thirds of the participants spent their childhood in South Canterbury (within the takiwa of Te Runanga o Arowhenua) while two of the participants grew up in the North Island (Figure 12).

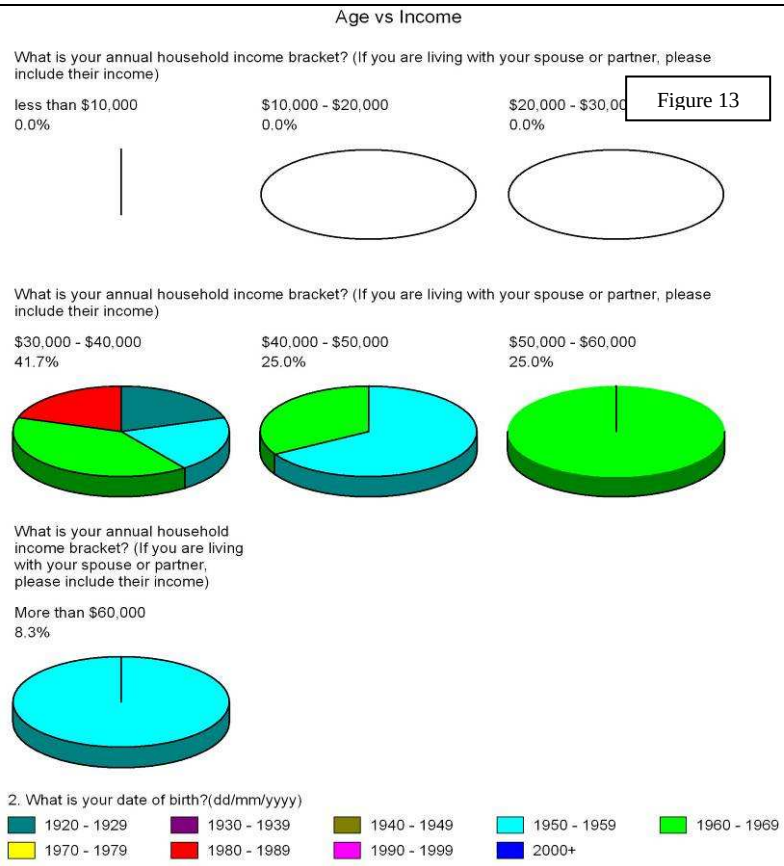


Figure 13

With respect to income (Figure 13)

- 41.7% received between $30,000-$40,000 – which was the lowest recorded.
- 25% earned between $40,000-$50,000.
- 25% earned between $50,000-$60,000.

The data relating to income, as shown in Figure 13, can be compared to data collected from the 2006 census when:

- 44 percent of Ngai Tahu reported an annual personal income of $20,000 or less, while 6 percent received over $70,000.
- The median annual income (half receive more, and half receive less, than this amount) for Ngai Tahu was $23,400 in 2006. In comparison, the median annual income was $21,900 for the total population of Maori descent, and $24,400 for the total New Zealand population.
- The median annual income was $30,200 for Ngai Tahu men and $19,200 for women.

5.2.2 Patterns of kai consumption

The principal purpose of the Kai Consumption Survey was to determine the extent of gathering by whanau living in South Canterbury. The range of species that are consumed are listed in Table 6.

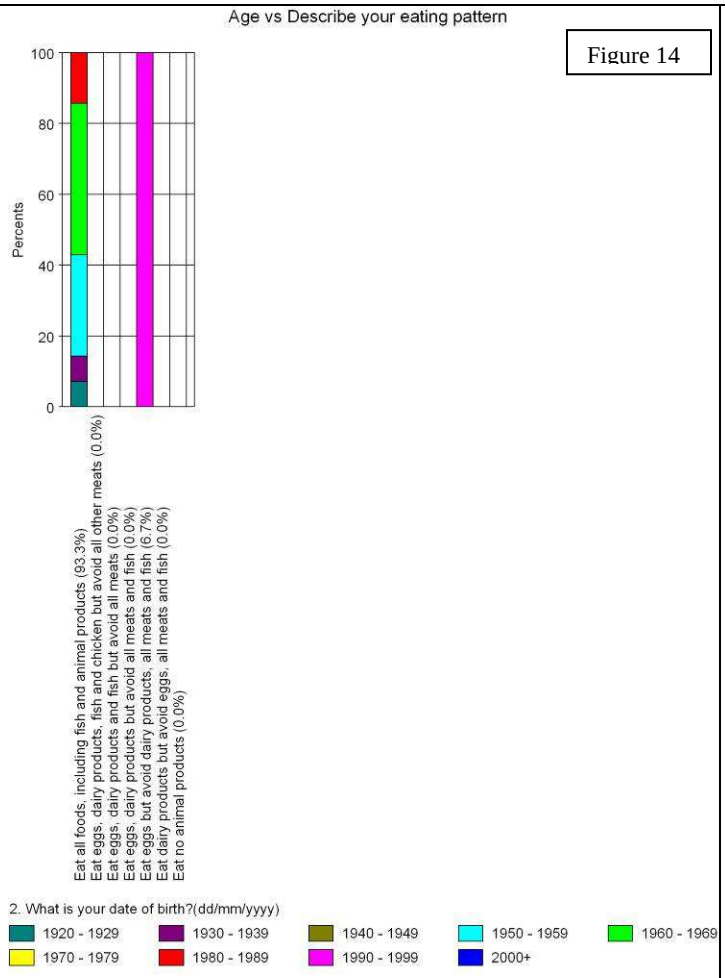
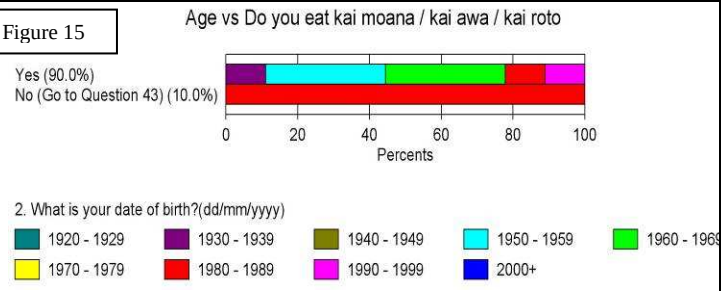


Figure 14

The majority of participants (93%) eat all foods, including fish, meat and all dairy products (Figure 14).

The exception was the tamariki who avoids dairy products, meats and fish.

Figure 15



90% of participants across all age groups eat kai moana, kai awa or kai roto (Figure 15). Only 10% (all aged between 20-29 years) do not eat kai moana, kai awa and kai roto.

Table 6: A comparison of foods historically sourced from sites in South Canterbury compared to foods gathered and consumed today.

KAI (**GATHERED** HISTORICALLY)	KAI (**GATHERED** TODAY)	KAI (**CONSUMED** TODAY)
		Butterfish
		Freshwater mussels
		Morihana
	Herrings	Herrings
		Pipi
		Cockles
		Toheroa
		Tuatua
		Greenbone
Kanakana	Lampreys	Lampreys
		Mutton birds
Eels	Eel	Eel
Flounder, Pakihi	Flounder	Flounder
Groper		Hapuka
Mullet	Mullet	Mullet
Kahawai	Kahawai	Kahawai
		Kingfish
		Gurnard
		Snapper
		Moki
Shark	Shark	Shark
		Tarakihi
		Trevally
Whitebait, Smelt, Minnows, Kokopara, Kokopu, Patete	Whitebait	Whitebait
	Trout	Trout
Sea urchins	Kina	Kina
Paua	Paua	Paua
	Mussels	Mussels
	Crayfish	Crayfish
	Oysters	Oysters
		Pupu
	Seaweed	Seaweed
		Freshwater crayfish
Watercress	Watercress	Watercress
Puha	Puha	Puha
Potato, turnip, cabbage		
Flax, flax honey		
Seals		
Aruhe		
Rats		
Koareare		
Sea nuts		
Whale		
Kauru		
Kumara		
Tutu		
Panako		
Weka		
Birds		
Taramea		
Shellfish		

Only 11 of the list of species gathered historically (as listed in Table 3) are still gathered and consumed today. These are highlighted in Table 6.

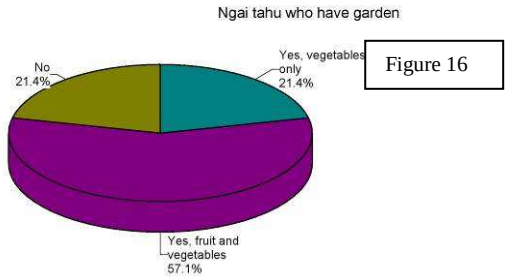


Figure 16

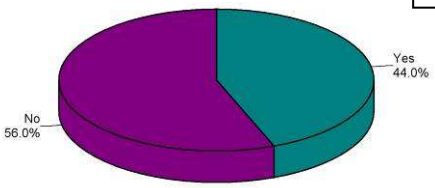
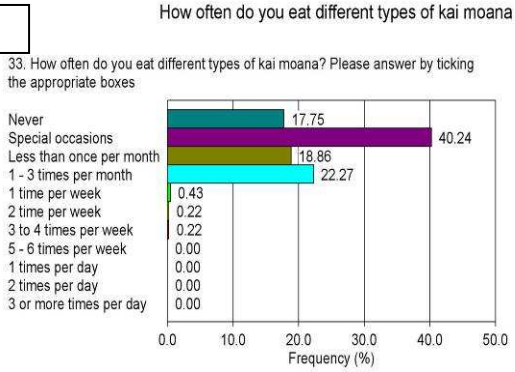


Figure 17

Figure 18



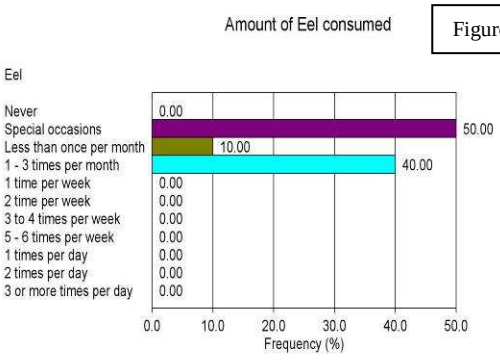


Figure 19

Consistent with the itinerant kai gathering lifestyle of their tupuna.

- 44% of respondents hunted, while
- 78.5% grew their own vegetables.
- Of the 78.5%, 57% of those who grew vegetables also grew fruit (Figures 16 and 17).
- The data also showed how after the introduction of potatoes and turnips by settlers, Ngai Tahu were quick to establish cultivations. However that was still combined with aspects of their itinerant lifestyle by resting lands and returning to use after being left for a period to recover.
- There is also a community garden and glass house at the marae.

Having determined that 90% of respondents do consume different types of kai:

- 40% of respondents said they now only eat kai on special occasions; while
- 18.9% eat kai less than once a month; and
- 22.3% only eat kai 1-3 times per month (Figure 18).

Figures 19 - 24 illustrate how often the various species are consumed:

- 40% of those eating eel have this food 1-3 times per month.
- It was of concern therefore that 70% of the respondents believed that there were now “a lot fewer” eels present.

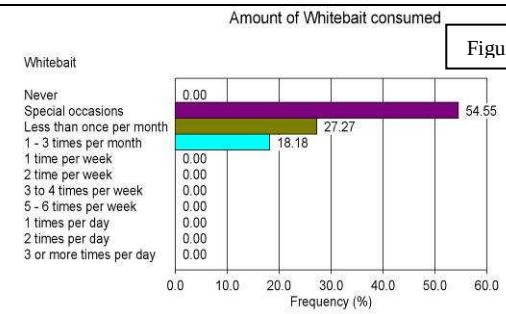


Figure 20

- For paua, whitebait, eel, flounder and crayfish at least 50% of the respondents indicate they consume these species at special occasions.

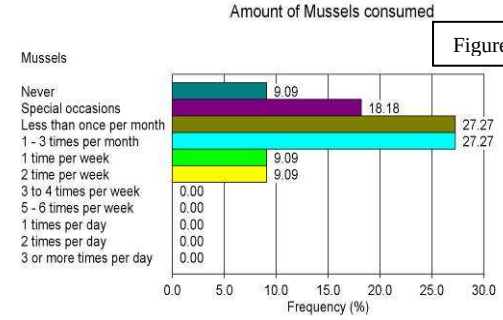


Figure 21

- Only mussels are consumed weekly – specifically once or twice per week. Interesting this is the only species that some respondents believed had increased in abundance.
- They also observed that mussels can now be easily accessed from supermarkets.

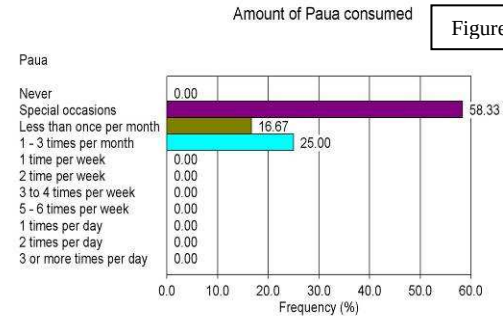


Figure 22

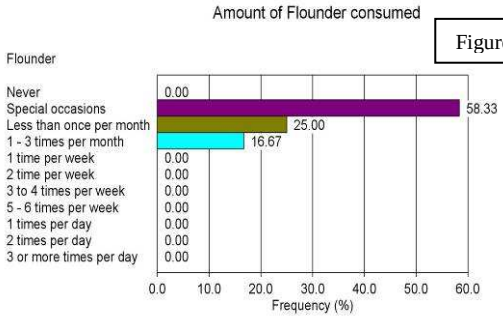


Figure 23

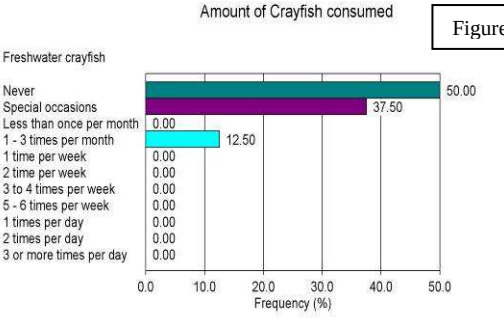


Figure 24

How respondents prepared their kai was also important. It was accepted that although many would prepare their own kai, others would purchase fish at take always, and supermarkets (as either fresh or tinned fish). Figures 25-27 illustrate the difference between age groups.

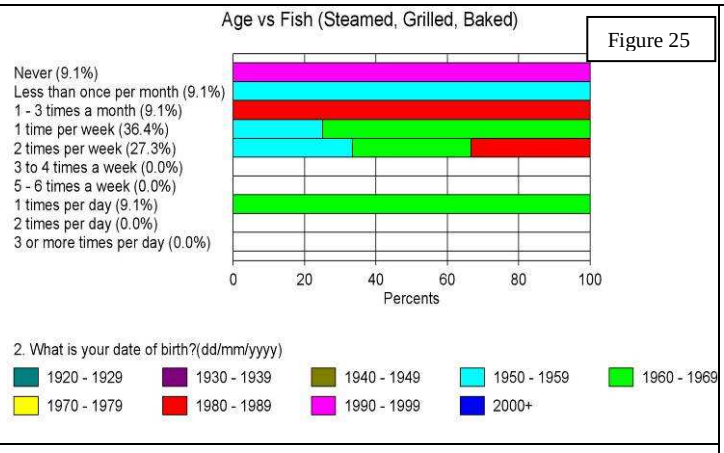


Figure 25

63.7% of respondents consumed steamed, grilled or baked fish at least 1 per week.

Today convenience foods can be purchased from a variety of sources and is available:

- As tinned fish;
- As fresh fish available in the deli of a supermarket; and
- As fish and chips at a take way store.

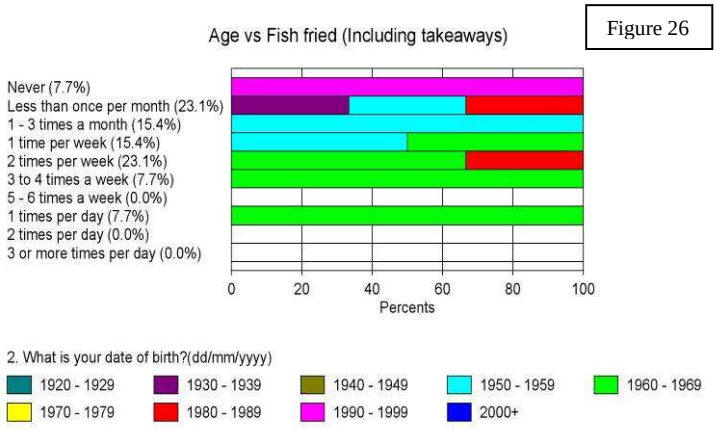


Figure 26

The graphs at left confirm that:

- Fried fish is consumed frequently and by one respondent at least once per day.
- 46.2% buy fried fish at least once a week.

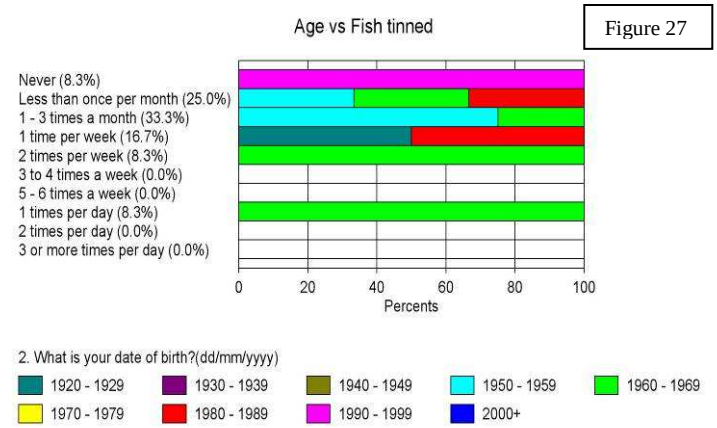


Figure 27

Interestingly Kaumatua consume fried fish less than once per month although in contrast they consume tin fish at least once a week.

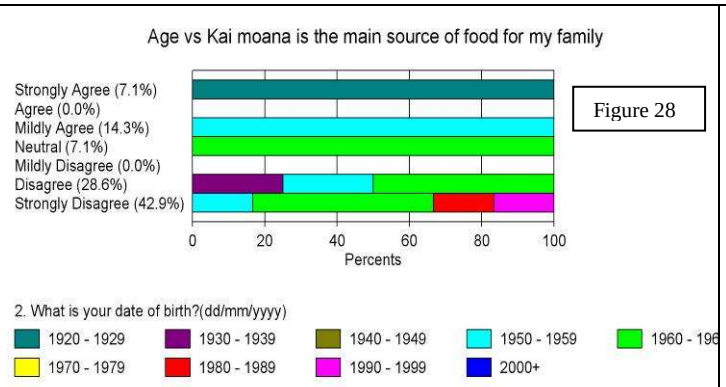


Figure 28

We wanted to determine how dependent whanau were on kaimoana. A question therefore asked if kai moana was the main source of food for the whanau.

- The oldest Kaumatua participating was the only one that strongly agreed with this statement.
- The others that agreed with this statement were aged 50-59 years. In contrast the rangatahi and tamariki participating all strongly disagreed with this statement. In fact 71% spread across four age groups disagreed or strongly disagreed – in other words kai was not the main source of food for their family.

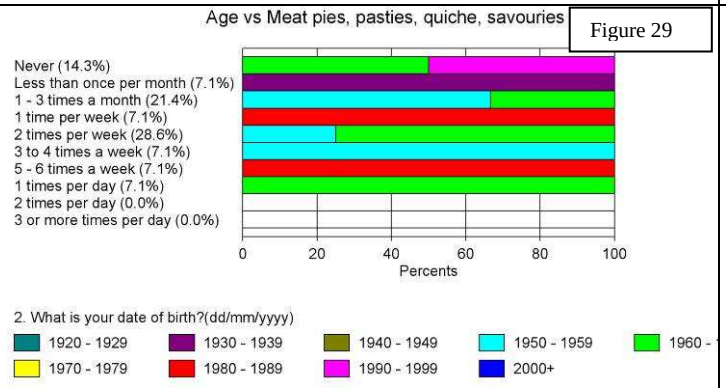


Figure 29

- Questions sought to identify changes from a traditional diet to a western style diet (Figure 29). It was of concern that 57% of respondents eat meat pies, pasties, quiche or savouries at least weekly, with 28% eating these foods twice a week and one participant eating these foods daily.

5.2.3 Estimates of the quantity of kai consumed

This research investigates the risk of contamination from eating wild sourced kai. A key consideration is the amount of kai that they are actually consuming. This is calculated by examining:

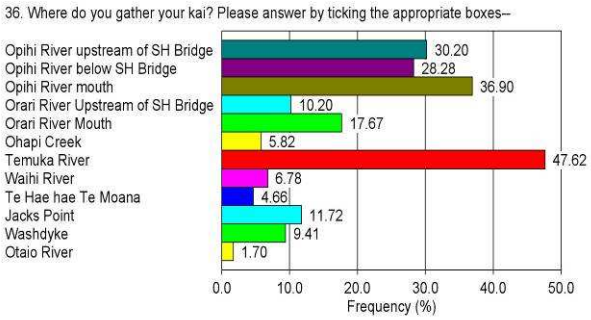
- the frequency or number of times they consume kai; and
- the quantity per sitting.

63.7% of respondents consumed steamed, grilled or baked fish at least 1 per week. From the data collected we also know that they consumed approximately 230.77 of fish per sitting. For mussels and whitebait the quantities change somewhat with participants consuming 157g and 302g per sitting.

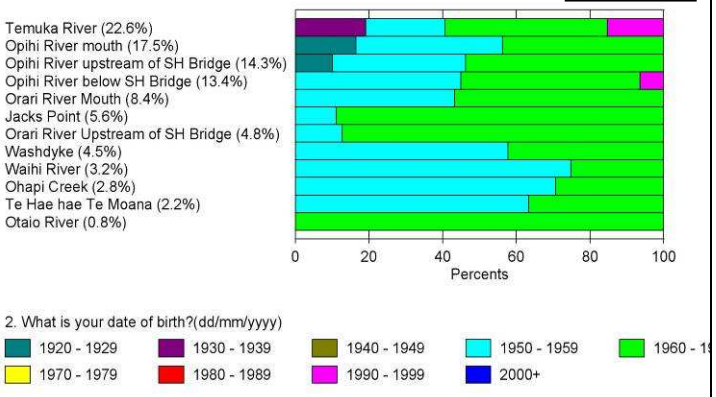
5.2.4 Sites at which kai gathering and other activities are undertaken

In addition to identifying the species gathered, the sites from which kai was sourced were identified. These sites were used as the basis for a sampling programme which examined contaminants in sediment and kai species (see Appendix 2 for site details). Figure 30 below confirms that 47.6% of participants gather from the Temuka River, while the Opihi River (upstream of State Highway 1, downstream of the State Highway, and the river mouth) are used by 30%, 28% and 37% of participants, respectively.

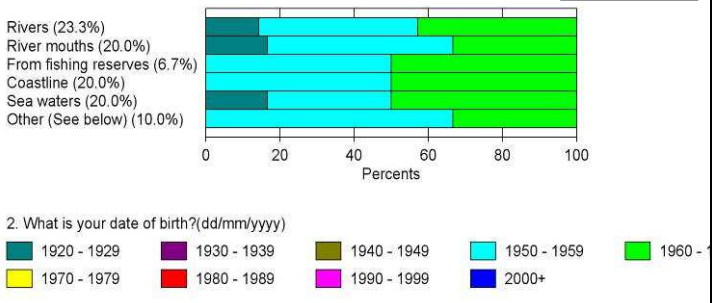
Where do you gather your kai — Figure 30



Age vs Where do you gather kai — Figure 31



Age vs Locations you gathered kai from — Figure 32



Of the sites listed in the Figures at left (Figure 30):

- There is easy access to the Opihi River and reserves at the river mouth.
- There are fishing easements on the south bank of the Orari River mouth and at Ohapi Creek.
- There is a reserve at Washdyke.

From the data collected it is also possible to identify the gathering preferences of the respective age groups (Figure 31):

- Kaumatua and tamariki fish locally from the Opihi and Temuka Rivers.
- Pakeke are the most mobile with those aged between 40-59 accessing most sites.

When identifying the reaches of a river that are fished by the respective age groups (Figure 32):

- Pakeke are the most mobile accessing most river types.
- Kaumatua limited their gathering to river mouths and coastal fishing.
- Only 6% fished from the reserves.

Figures 33 and 34 the various species that are sourced from the different waterbodies and the relative proportions of each species gathered.

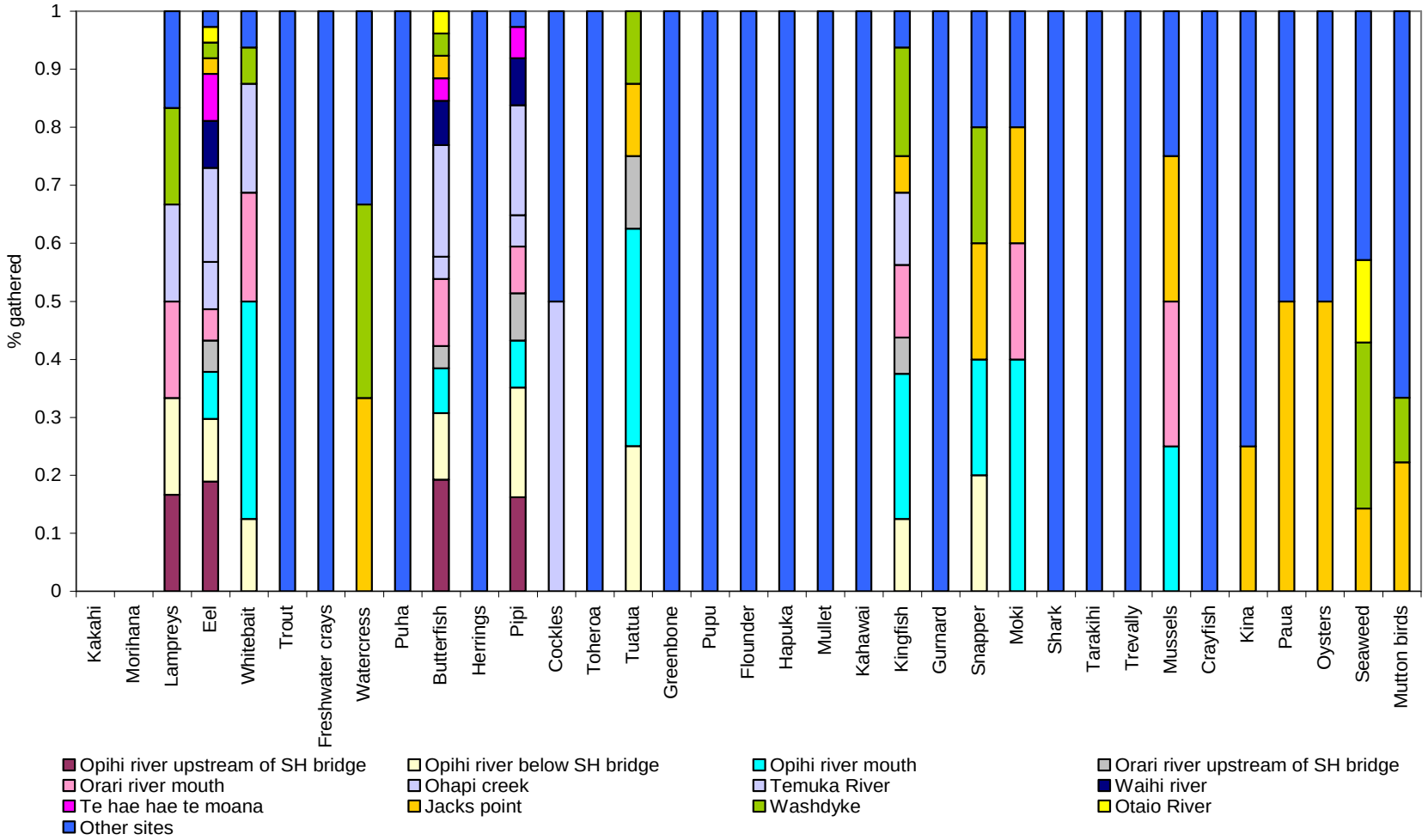


Figure 33: Relative proportions of sites from which the different species of kai were gathered.

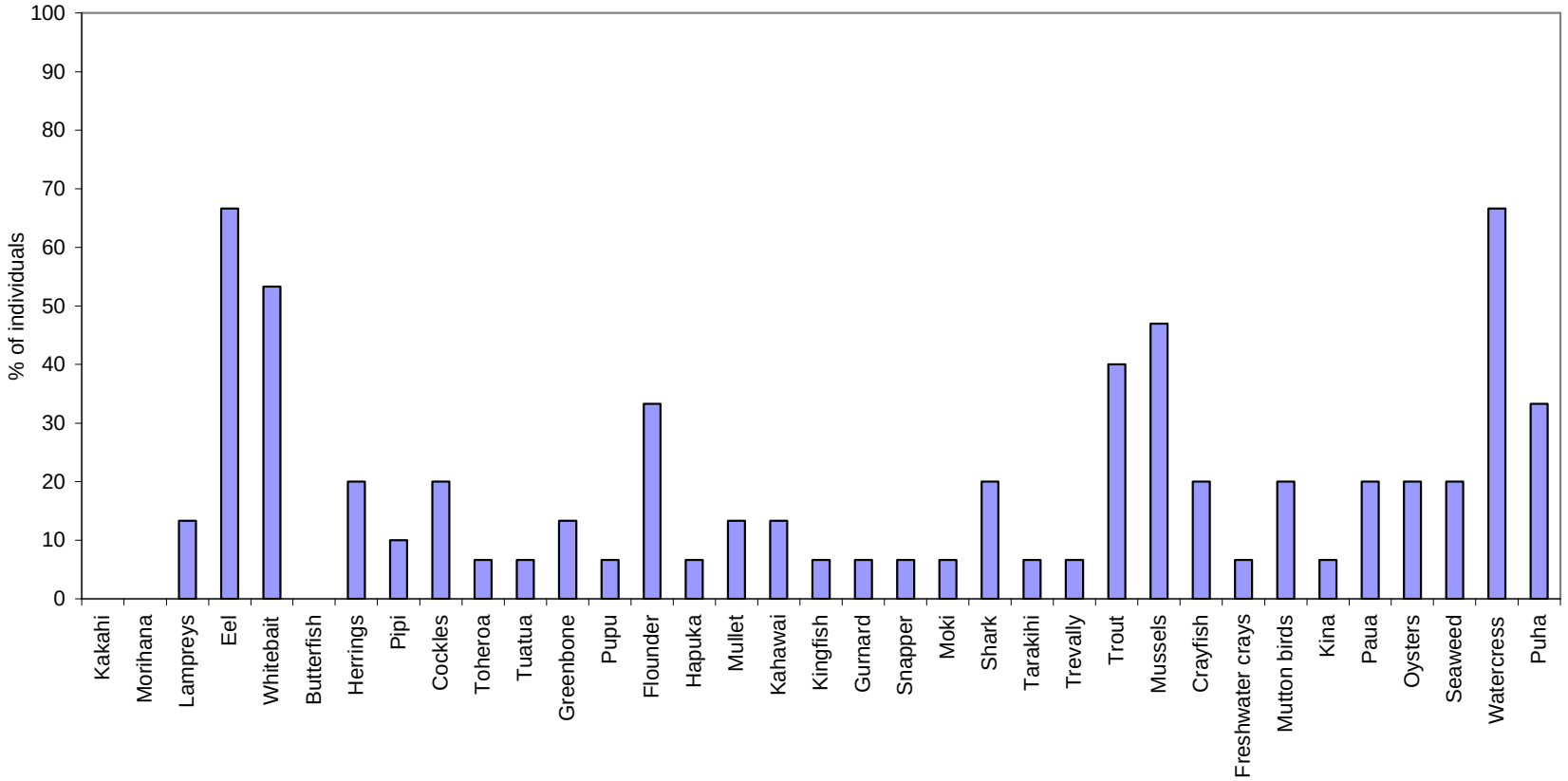


Figure 34: Percentage of individuals that gather different kai species.

In addition to gathering data about kai, data were collected about other activities undertaken at the respective sites, as contact with these waters could be a source of exposure to contaminants, rather than kai consumption. Figures 35-44 illustrate these additional activities. In summary:

- Swimming at some sites reflects their perceived high water quality.

- The two sites on the Opihi, in proximity to the State Highway Bridge, are popular for swimming with all respondents who use these sites.

- These two sites on the Opihi plus the Temuka also supported the greatest range of activities by whanau.

- The Temuka River and the Te Hae Hae Moana River are also swimming spots – again all respondents using these sites say they swim there.

- Sites that are known to be adversely impacted by activities in the catchment (and thus suffering degraded water quality) received mixed levels of use:

    - Jacks Point supports a range of fishing related activities but limited swimming (only 25%).

    - Ohapi Creek, one of the fishing easements, is used solely for fishing.

    - Washdyke, one of the reserves, is used solely for fishing.

    - Opihi River Mouth supports a range of activities but only 40% of the respondents swim there.

    - Otaio does not support swimming.

Photos are included beside each figure to give a visual depiction of the site.

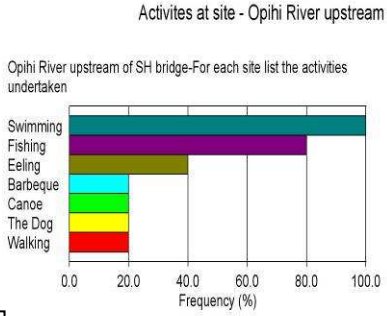
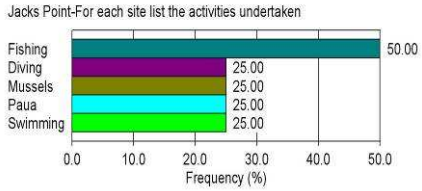


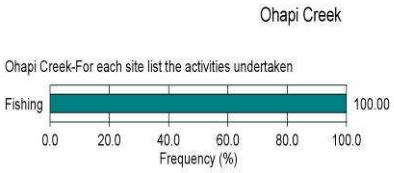
Figure 35

* Note: Multiple answer percentage-count totals not meaningful.



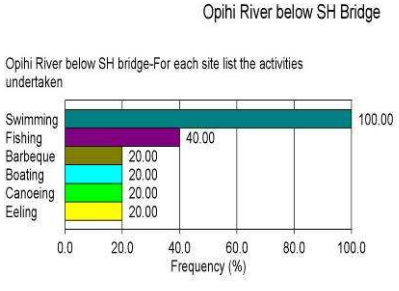
* Note: Multiple answer percentage-count totals not meaningful.

Figure 36



* Note: Multiple answer percentage-count totals not meaningful.

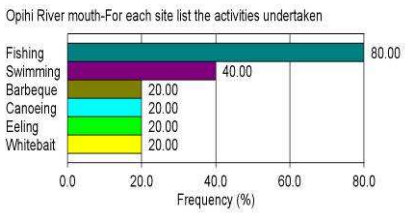
Figure 37



* Note: Multiple answer percentage-count totals not meaningful.

Figure 38

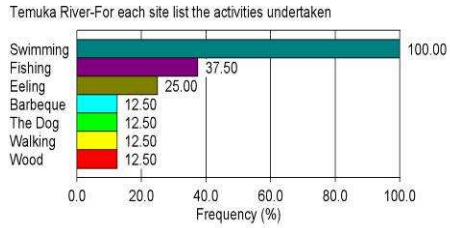
Opihi River mouth



* Note: Multiple answer percentage-count totals not meaningful.

Figure 39

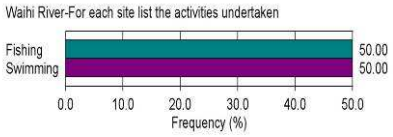
Temuka River



* Note: Multiple answer percentage-count totals not meaningful.

Figure 40

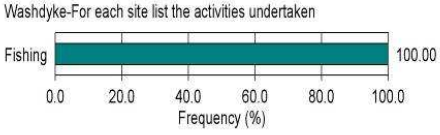
Waihi River



* Note: Multiple answer percentage-count totals not meaningful.

Figure 41

Washdyke



* Note: Multiple answer percentage-count totals not meaningful.

Figure 42

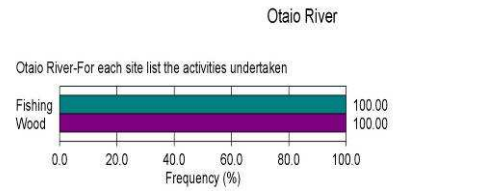


Figure 43

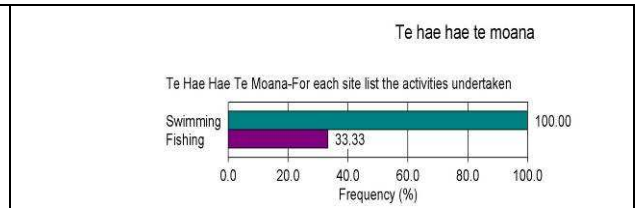


Figure 44

5.2.5 Other sources of kai

This project aims to assist the risk of exposure to contaminants associated with kai gathering. If there are concerns about the safety of kai consumed, and people are consuming kai that has been gifted, it is important to know where the kai comes from.

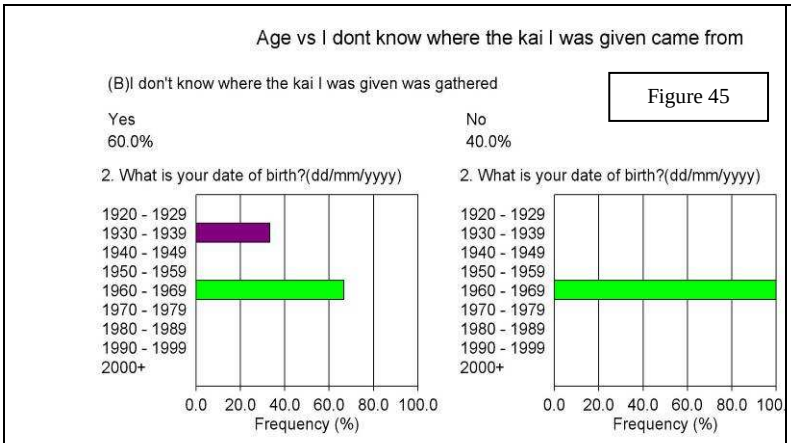


Figure 45

60% of respondents indicated that they did not know where the kai they were given was sourced.

Assuming the sites whanau gather from would change if the condition of the site was degraded; respondents were asked if they were able to gather from the sites that they have always gathered from.

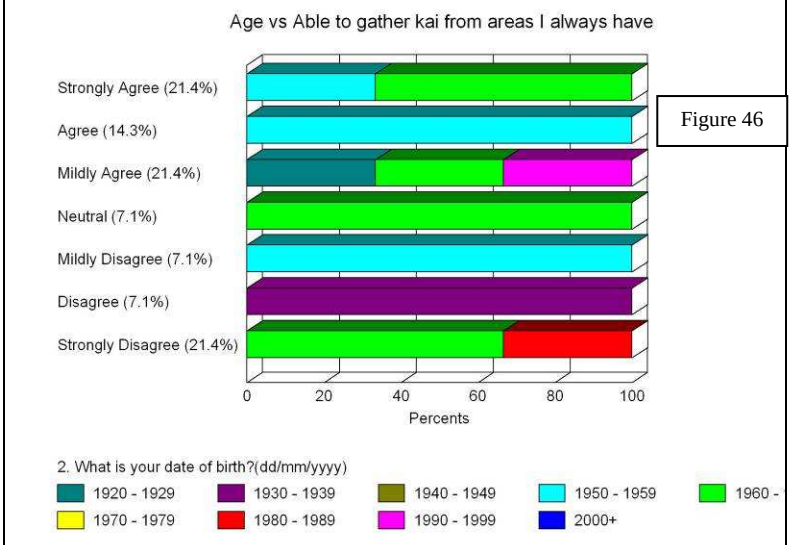


Figure 46

- 56% agree that they can.
- 35% say that they cannot.

No trends can be detected when looking at the respective age groups.

As whanau explained:

I still go there (Washdyke) on the sea side of it when it's (whitebait) in season and I still venture into the lagoon for kanakana.

We have gone as far Rangitata and Moeraki. With Moeraki always being used for paua and pupu which were gathered with Aunty and she would show us how to make kelp bag.

Paerora River was where they washed the bodies. I have just found out When we were younger we would go to the Waihao for kanakana and eels and we never touched the Paerora but I never knew why till now.

My favourite eeling spot is between the Temuka Road Bridge and the Manse Bridge and beyond. In that stretch of water when we were young we could catch around 50 eels and it was no hassle. You would see as many go past you as you spear but today in that same stretch of water you would see 5 eels that were not able to take.

Mainly around here I go to the Opihi. But lately in the last few years I wouldn't go floundering there because of the smell as the lagoon would get built up and water get stagnant and really bad smell. To me it goes to the fish and you couldn't eat it.

To Jacks Point for mussels. A lot of people gather around the wharf but I wouldn't because of all the oil and stuff that comes from the boats. I would go to Jacks Point where it's a lot cleaner.

The prime area being the Temuka and Opihi River and Awarua River (joined the Temuka straight across from the Marae). Awarua River was where we get a lot of watercress and we still do and freshwater koura. And tuna those were the basic ones we took from there.

5.2.6 Preferred kai species

Tuna was a major part of our diet. Most people didn't have the money to go out and buy food so they would use the awa as much as possible. They would go through the seasons from eeling in the summer through to March. Then move to kanakana in June / July / August in the colder parts of the season and whitebait as well. Then tuna would start to come back into season September onwards.

There was always kai around. If you couldn't get it in one place you would go to other places. If we didn't get paua here we would go down to Moeraki and if we couldn't get tuna here we would go somewhere else. It all depends on the time of year. We get patiki at certain times of year at spring time. There was always an abundance of food at that time but there was also a matter of storing it and preparing it so you could keep.

A question asked respondents to choose from the list of kaimoana, kai roto, or kai awa species those that they most preferred to eat. They were only allowed to choose their "top 6". These were to be their preferred kai.

- "1" was to be written beside their most preferred food;
- "2" was to written alongside their second choice;
- down to "6" which is to indicate their 6th preference.

Surprisingly, the top 6 preferences according to the ratings (in order of preference were):

5. snapper, koura
6. kina
7. trout
8. pupu, pipi, cockles, herrings, oysters.

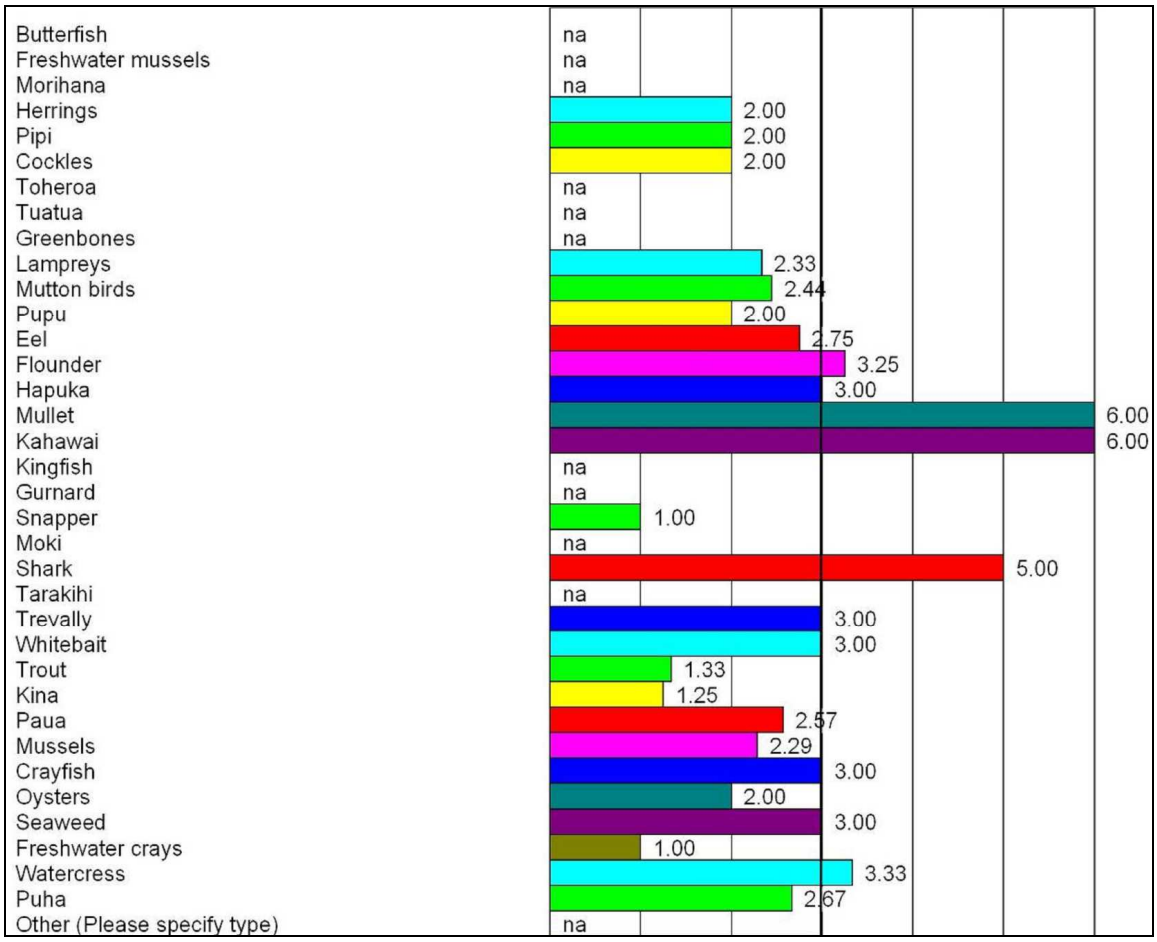
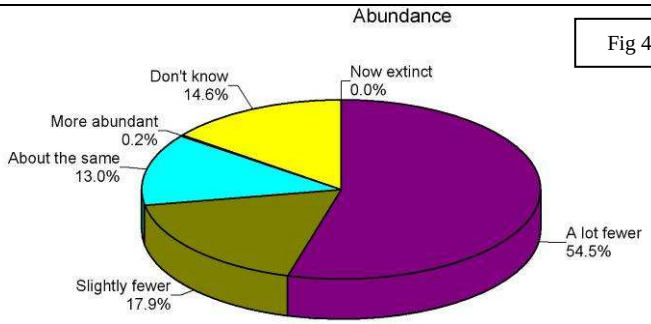


Figure 47: Preferred kai species (Numbers 0- 6 on the x axis represent the preference of whanau – 1 being the most preferred and 6 the lease preferred)

5.2.7 Perceived changes in the abundance of species that are gathered

If kai moana, kai awa and kai roto are to be promoted as a beneficial source of food for whanau, there need to be sufficient quantities of healthy stocks in order to sustain gathering. Questions in the Kai Consumption Survey asked whanau to provide their assessment of the stocks of various species gathered.



Of concern 54% of respondents believed that across all species gathered there were now a “lot fewer” available while another 17.9% believed that abundance was “slightly fewer”(Figure 47).

Table 8: Changes in the abundance of species (as a percentage)[7].

SPECIES	A LOT FEWER	SLIGHTLY FEWER	ABOUT THE SAME	MORE ABUNDANT
Butterfish	25	25	25	-
Kakahi	50	25	25	-
Morihana	33.3	33.3	-	-
Herrings	50	25	25	-
Cockles	37.5	37.5	-	-
Pipi	40	20	-	-
Toheroa	50	25	-	-
Tuatua	33	33	33	-
Greenbone	50	25	-	-
Lamprey	75	12.5	12.5	-
Mutton birds	50	12.5	25	-
Pupu	60	20	-	-
Eel	70	20	-	-
Flounder	57	14	14	-
Paua	71.4	14.3	14.3	-
Mussels	50	25	12.5	12.5
Crayfish	66.7	16.7	16.7	-
Oysters	60	20	20	-
Seaweed	66.7	-	33	-
Koura	50	25	25	-
Watercress	37.5	25	25	-
Puha	45.5	18.2	27.3	-
Hapuka	50	25	-	-
Mullet	50	25	-	-
Kahawai	50	25	25	-
Kingfish	33	33	-	-
Gurnard	33	33	-	-
Snapper	33	33	-	-
Moki	50	25	-	-
Shark	50	25	25	-
Tarakihi	66.7	-	-	-
Trevally	66.7	-	-	-
Whitebait	70	10	10	-
Trout	14.3	42.9	28.6	-
Kina	75	25	-	-

As whanau explained:

Eels have diminished in number and they are probably the last species to be affected. You were once able to get crayfish you can't get crayfish in the local area. Paua again have diminished in number and size…..We now go to Moeraki to get them or elsewhere. Same thing for mussels they are virtually gone.

[7] Perceptions with respect to individual species are summarised in Table 8 with graphs included as **Appendix 1**

There are flounders we are finding now because of the quality of water in the lagoon and unless the mouth is open constantly then the patiki is muddy are horrible to taste. We don't even bother going out when the mouth is closed. It's tainted.

Our very best catchers can't get our customary take, as you can't get it. It's down to commercial eelers. Even 10 to 15 years ago if there was a tangi you could walk from the Temuka Bridge to the Manse Bridge which is about 800m and you would get at least a full bag of eel. Now you would be lucky to get two. You may get a dozen if three or four people were out with torches.

Watercress as well, there is a lot less around and the sprays they use these days and the run off from the farms in polluting the rivers.

Whitebait has dropped off in quantity with sometimes having a reasonable season but 99% of time it has diminished and more whitebaiters. Tuna is slowly disappearing.

5.2.8 Kai gathering behaviours

It cannot be assumed that all kai consumed is gathered by the respondents. Questions in the survey therefore asked about purchasing kai and sought to understand if it was shared within the whanau and wider community.

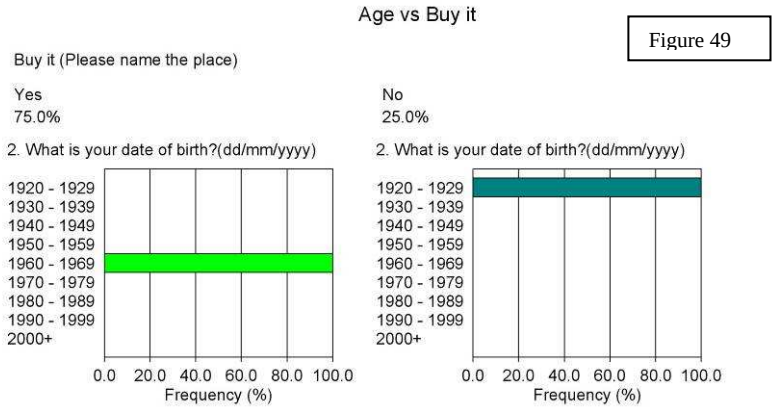


Figure 49

- 75% (all aged 40-49 years) buy some of their kai (Figure 49)
- The kaumatua did not purchase kai.

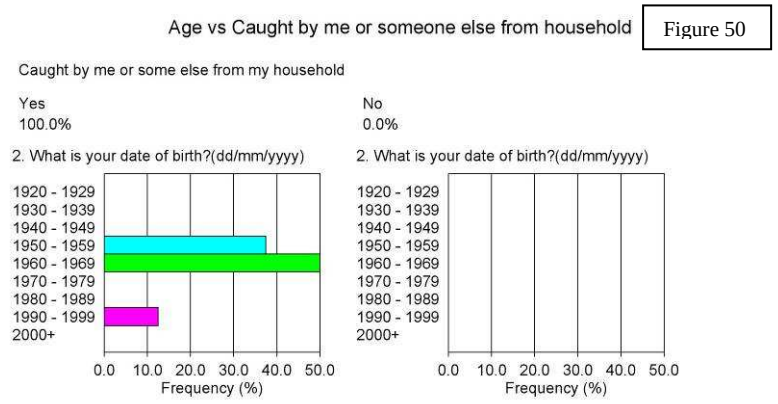


Figure 50

- Those aged 40-59 years and the tamariki confirmed that they caught their own kai (Figure 50).

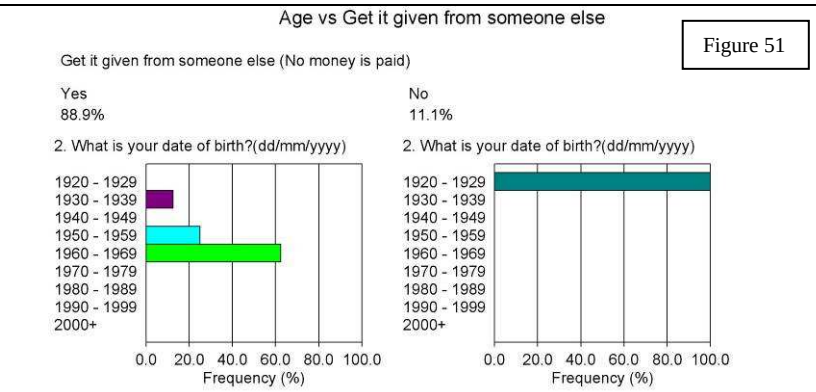


Figure 51

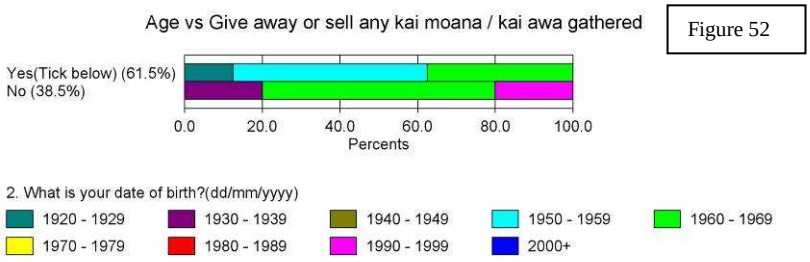


Figure 52

- 88.9% of participants said that they also were given kai (Figure 51).
- One kaumatua indicated that they were given kai from someone else as a koha while another kaumatua indicated that they were not given kai.

- 61% of participants gave away or sold some of the kai they gathered (Figure 52)

Aside from knowing how to gather kai, whanau need to know how to prepare the respective species.

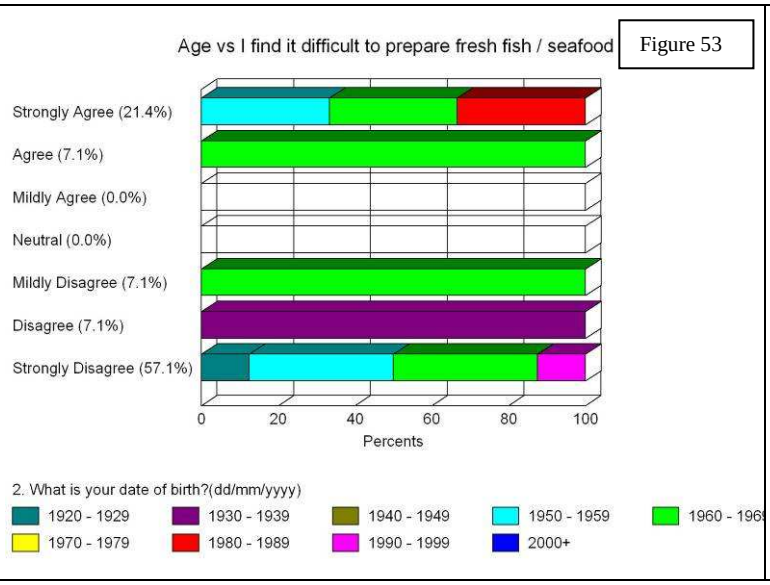


Figure 53

71% of respondents disagreed with the statement (57% strongly disagreeing) that it was difficult to prepare fresh fish and seafood. In other words 71% knew how to prepare their kai (Figure 53).

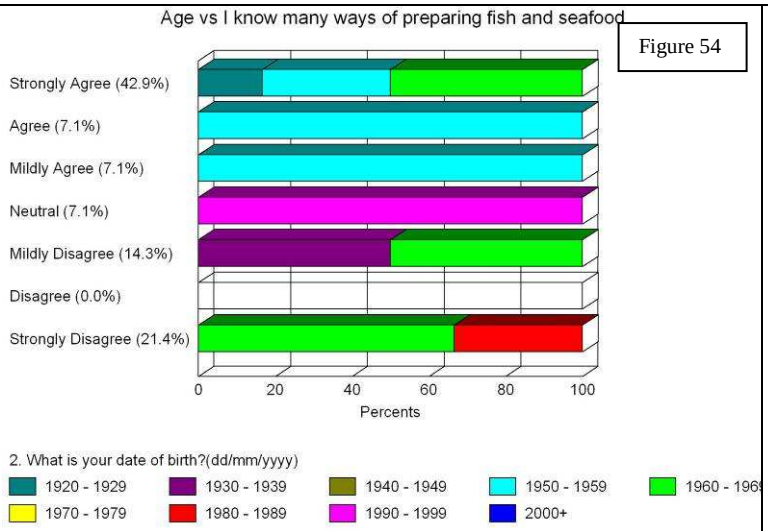


Figure 54

Of note however was the difference between generations.

Kaumatua disagreed with the statement. In contrast those: 57% of respondents (all aged 40 years and over) know many ways of preparing kai (Figure 54). In contrast and consistent with the earlier observation, those aged 20-29 years replied that they definitely did not know multiple ways of preparing kai.

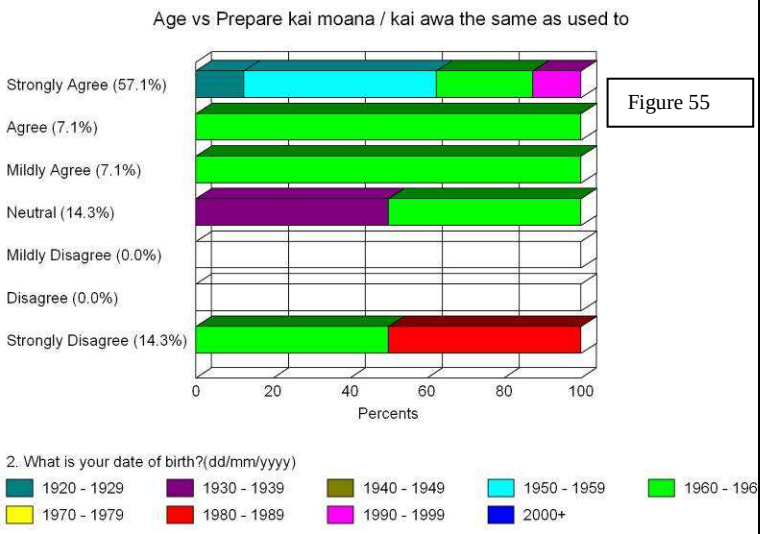


Figure 55

Interestingly Kaumatua (aged 70-79 years) also indicated they didn't really know many ways of preparing kai which could be interpreted as saying they prepare kai the same way that they have always done (Figure 55). In fact, 71% of respondents indicated they prepared their kai the same way as they have always done.

5.2.9 Perception of the environment

Maori experience environments and central to their continued interaction and utilisation of environments will be their perception of the good health of such areas. A number of questions in the survey asked for them to give an assessment of the condition of the sites from which they gather kai.

Figure 56

Responses were mixed when asked about the condition of sites (Figure 56), with:

- 35.7% believing sites to be in good condition while
- another 28.6% did not provide an assessment.
- only 28% appeared to believe that sites from which they gather are not in a good condition.

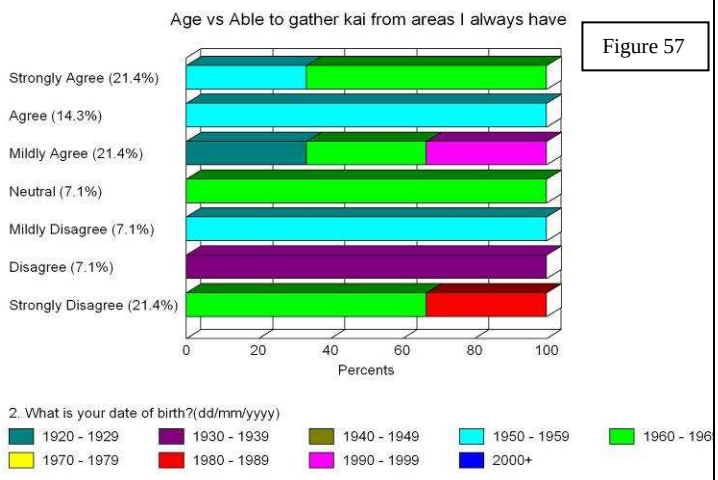


Figure 57

This is supported by the assessment of 57% of respondents (all aged 40 years and over) believing that kai could be gathered from the same sites that have always been accessed (Figure 57). An exception being a kaumatua (aged 70-79 years) who believed they could no longer gather from the sites they have previously been able to.

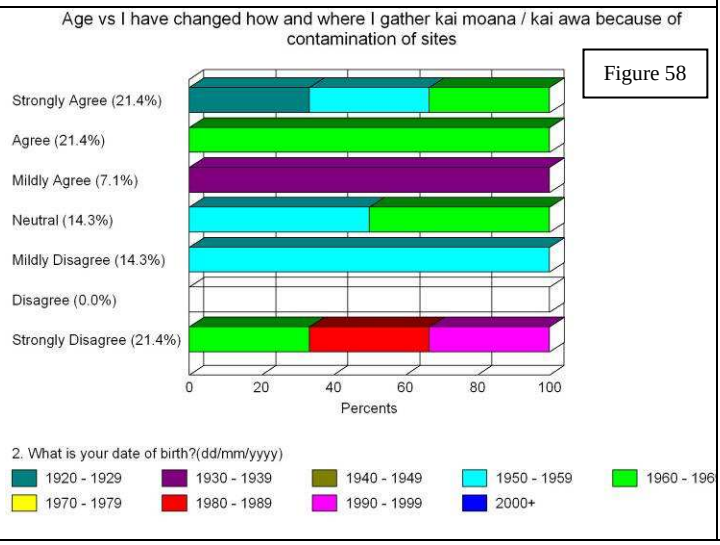


Figure 58

Responses were also mixed when asked about changing the sites they gather due to perceived contamination at the sites (Figure 58):

- Kaumatua agreed that they had changed gathering behaviours.
- 50% had changed their gathering behaviour (all of them aged 40 years or over).
- Those who strongly disagreed were all aged less than 40 years.

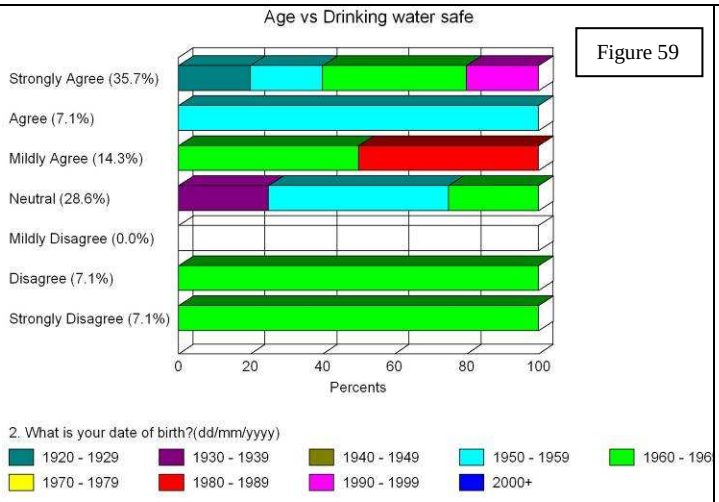


Figure 59

The majority of participants (56.8%) believed that their drinking water was safe (Figure 59). But 28.6% did not comment.

No clear trends emerged when asked if kai gathering was dangerous to the health of respondents because of pollutants or toxins.

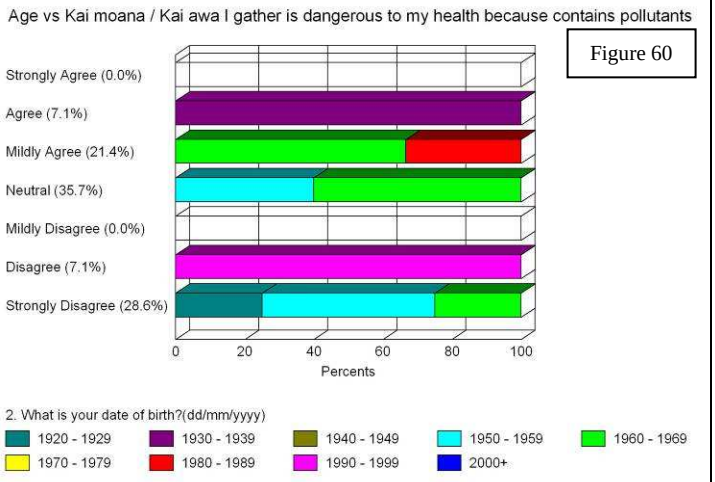


Figure 60

In relation to pollutants:

- 28.6% strongly disagreed with the statement that the kai gathered was dangerous to human health because of pollutants (Figure 60).
- However 35.7% did not provide an assessment.

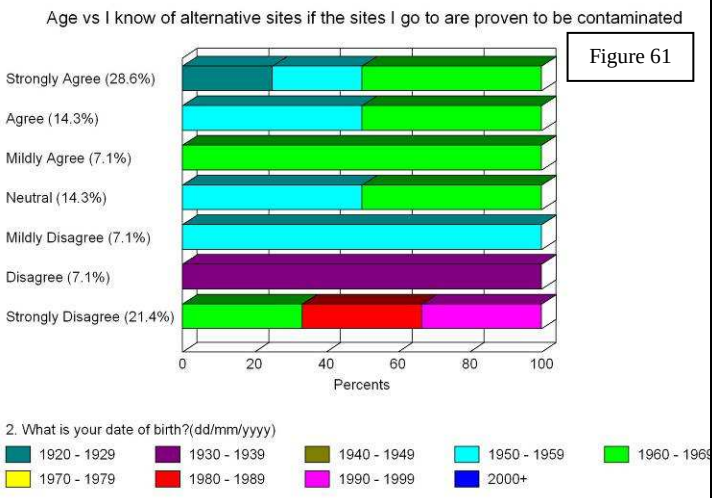


Figure 61

If a site is contaminated then the expectation would be that alternative sites would be used.

However only 50% knew of alterative sites that they could use (Figure 61). 28.6 strongly agreed.

Rangatahi and tamariki disagreed strongly indicating that they did not know how to change their behaviour and gather from alternative sites.

Whanau commented that:

The size of the lagoon has decreased because of drainage. At Temuka it used to be made up of 99% of swamplands and streams and places where eels used to be and watercress up the side but it's all drained and dry now. Creeks around the farms have been drag-lined and they

clean them out every two or three years so there is no place for the eels, no habitat and whitebait have no breeding ground. So that is why they are going down.

Washdyke we don't go there anymore because of industrial waste and if you go there it's for little as possible. You wouldn't go with all the pollution from the boats and things in harbour.

Tuna we are more worried about now because its the only thing left to us. The kanakana I go further afield because the habitat is not there anymore. The rivers are so low there is no soil banks they used to settle in to. Likewise with eel there is no real place for them anymore so their habitat has changed.

Because of low levels of river when gathering kai, like kanakana, you have to make sure the mouth is open and if its not to get same kai you have to go to Waihao.

The [taint] its worse with flounder and whitebait that's why I go to Orari now for whitebaiting. I would rather whitebait at Opihi but if water sits there for weeks and you catch it you can taste it and smell it when you eat it. Since the dams been up there the water quality down here has been bad.

5.2.10 Health of whanau members – Self Reported Rates of Diseases

Participants were asked to self report diseases prevalent in the family (Figures 62 and 63).

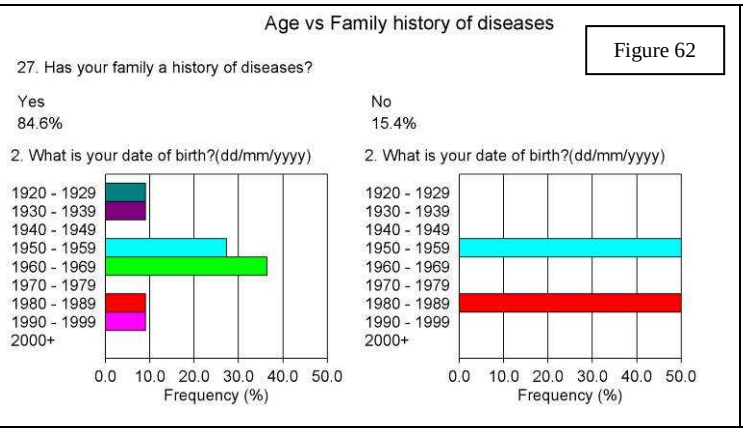
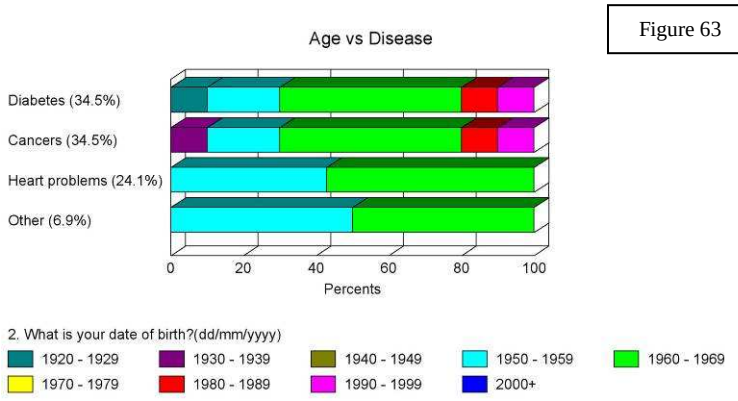


Figure 62

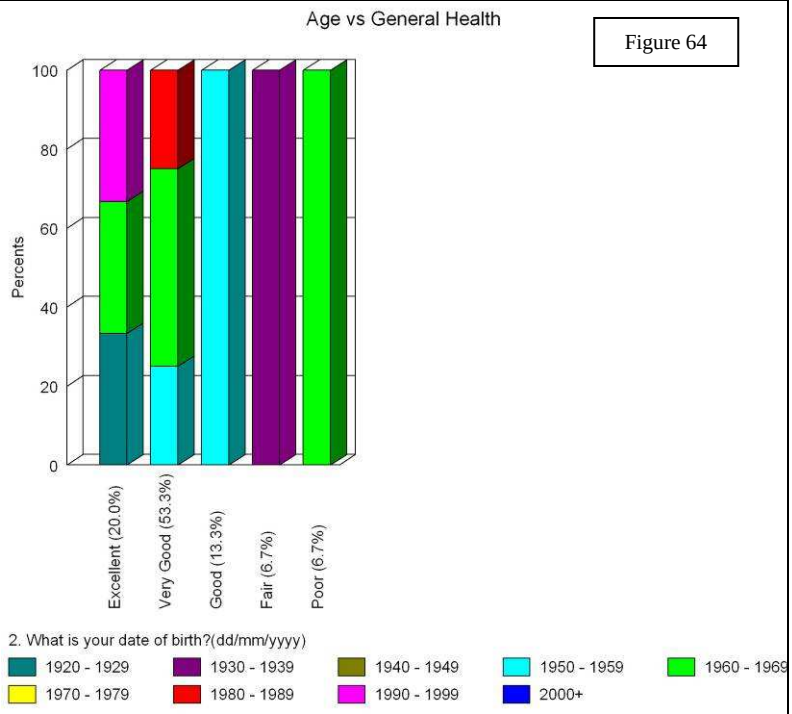
- 84.6% reported that there was a history of disease in their family.
- 34.5% of participants, across five age groups, reported a history of diabetes within their whanau.
- 34.5% of participants, across five age groups, reported a history of cancers within their family.

Figure 63



- 24.1% of respondents, all aged between 40-59 years, reported health problems.

Figure 64



Despite the prevalence of illness in their whanau (at above average rates) 87% of the individuals participating rated their health as good, very good or excellent (Figure 64). Only two of the respondents (one aged 70-79 years and the other 40-49 years) rated their health as fair or poor respectively.

Other age group observations:

- The eldest participant considered their health as excellent.
- All those aged 50-59 years rated their health as good or very good.
- The greatest variation was in the 40-49 years age group with participants rating their health poor, very good or excellent.
- As expected, the youngest participants (aged 10-29 years) considered their health very good or excellent.

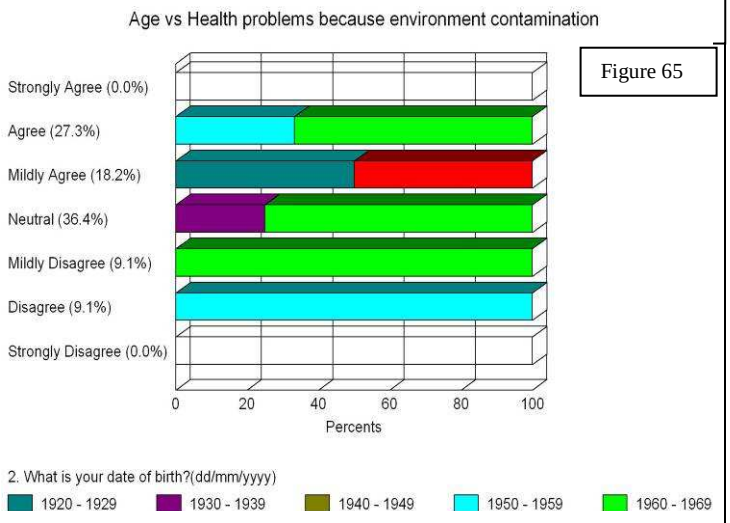
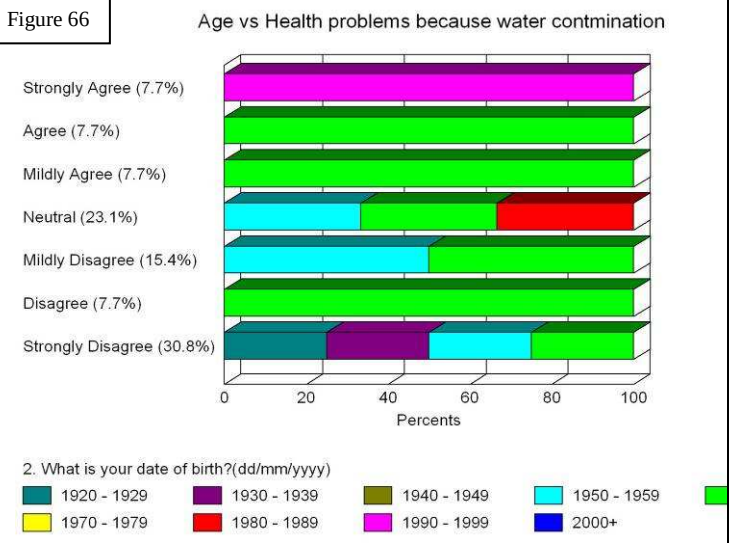


Figure 65

Two questions in the survey asked if respondents believed their health problems could be attributed to environmental contamination or more specifically water contamination (Figure 65).

With respect to environmental contamination, a third were neutral, while 45% of participants across most age groups agreed with the statement. Only those aged 40-59 years of age disagreed with the statement that their health problems were the result of environmental contamination.

Figure 66



Interestingly the majority of participants (53%) disagreed with contaminated water being the source of their health problems while another 23% provided no comment (Figure 66).

Kaumatua strongly disagreed.

5.2.11 Disseminating advice about contamination issues

One of the outputs of this research is to be a risk assessment framework. If it is to be implemented effectively it needs to reach grass roots Maori. A number of questions therefore sought data on how information should be communicated and who should be responsible for delivering the message.

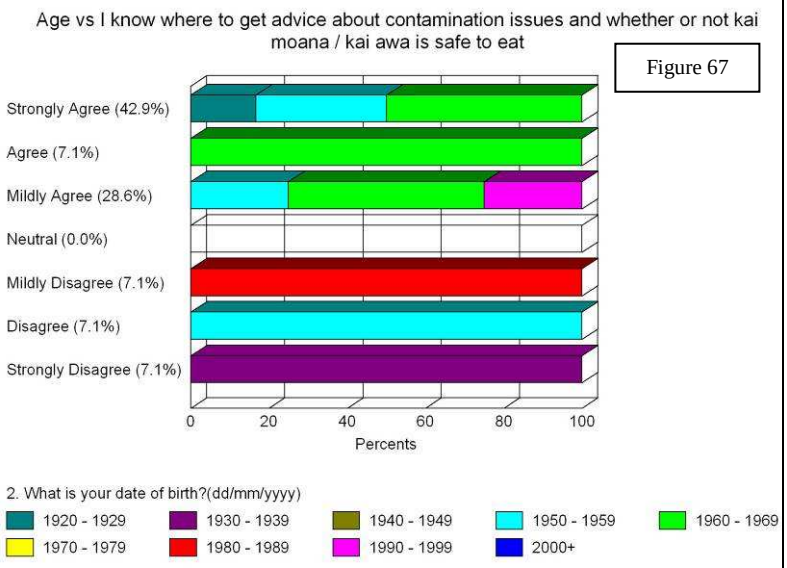


Figure 67

42.9% of respondents indicated they definitely knew where to get advice about contamination issues (Figure 67).

A further 35% responded less confidently but also said they knew where to get information from. Only 21% (and two specific age groups – rangatahi and Kaumatua) did not know where to go to obtain information.

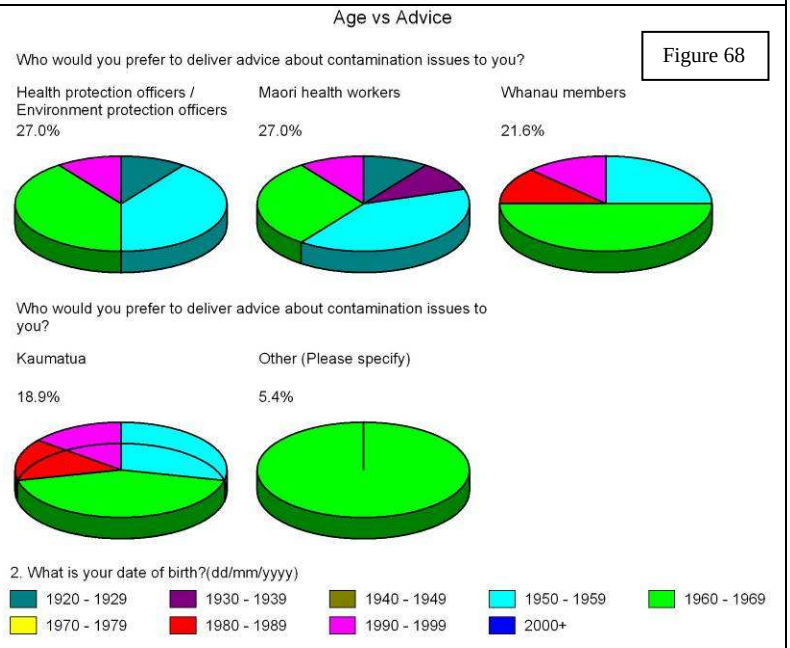


Figure 68

There is no clear preference for who should deliver the information, with similar preferences given to: HPOs/EPOS, Maori health workers and whanau members (Figure 68).

Similarly there was no clear preference with respect to the means of communicating which in fact suggests that a

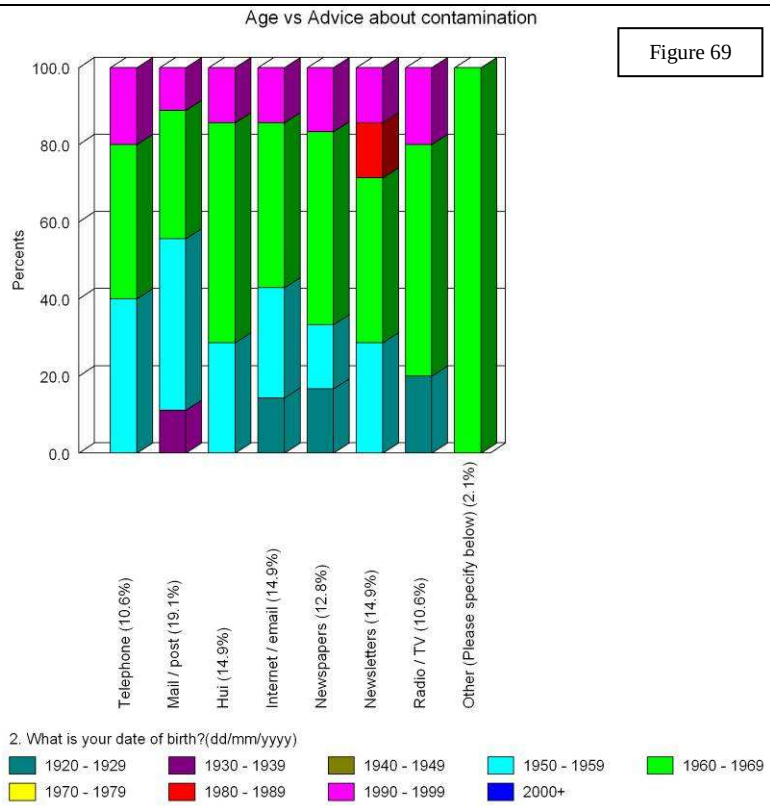


Figure 69

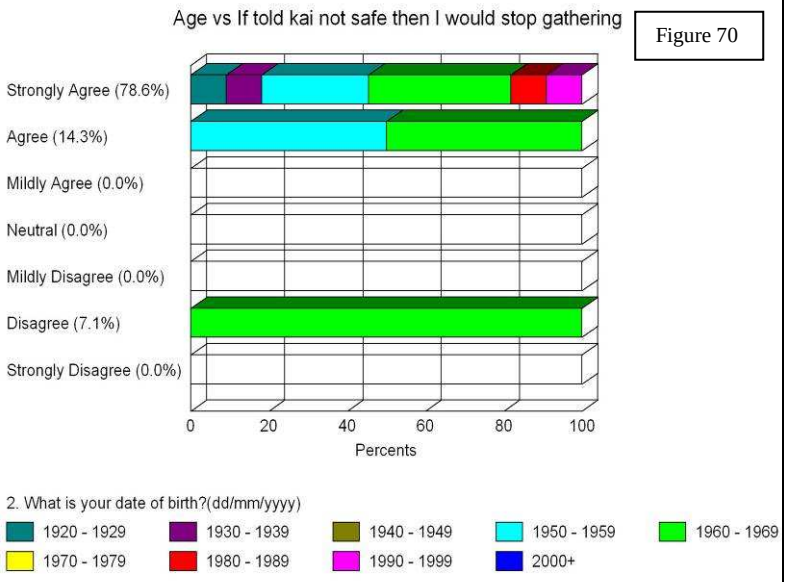


Figure 70

range of media should be used (Figure 69).

When reviewing the means of communicating we need to be cognisant of the equipment needed by whanau. Although not specific to South Canterbury, at the time of the 2006 Census:

- 66 percent of Ngai Tahu lived in a household with Internet access, an increase of 26 percent from 2001 (40 percent).
- 85 percent of Ngai Tahu lived in a household with access to a cell phone.
- 2 percent of Ngai Tahu lived in a household with no access to telecommunication devices (cell phone, telephone, and Internet or fax machine).

- The final result (Figure 70) concerns the long-term outcome of this result programme. Importantly, 93% of respondents (across all age groups) indicated they would stop gathering kai if advised that kai was not safe.

6. Discussion - understanding the socio-economic-cultural importance of kai to whanau and hapu

> *Indigenous relationships to the land are based in cultural practices. Harvesting of traditional foods is a central, material part of this relationship. A key problem for indigenous peoples occurs when, because of the practices of competing world views such as those often held by colonial states, practising these material connections becomes difficult. Problems ensue. These problems include issues related to health and well-being, and a disruption of well-established life-ways.* (Fediuk & Thom, 2003, p 1)

The discussion in this chapter re-examines traditional and contemporary consumption patterns of kai gathering, processing and consumption, the health of significant sites, and environmental change over the last 160 years to identify drivers of the transitions from a traditional kai based diet to a western diet. Insights, firstly, concerning the impact of dietary changes and secondly, the ongoing risk of exposure to contaminants and the impacts of this risk on the health and wellbeing of whanau are discussed. We have attempted to discuss these impacts in the wider political/social/cultural context in order to give a more complete reporting of cultural-environment relations.

6.1 Research results in the context of international literature

We have tried to convey the contradictions and challenges that surround the issue of contamination of kai:

1. Kai gathering contributes to the health and well bring of Maori by sustaining many cultural beliefs and values central to the identity of hapu. However the gathering of contaminated kai could be having a significant adverse impact.

2. Furgal (2003a) explains that the idea that potential health risks are associated with foods and a way of life previously regarded as “safe” has proved difficult to convey to Aboriginal peoples in North America. The individuals to whom risk information about the safety of their foods is to be conveyed have grown up living, hunting, and travelling over lands and rivers in a harsh and sometimes dangerous environment. Maori find themselves in the same situation of having to re-learn what is “safe” and what represents a health risk for them.

6.1.1 Structure of this chapter

Ngai Tahu have continually asserted their right to have their mahinga kai practices protected. However, many whanau in South Canterbury have witnessed the degradation of valued habitats and experienced significant barriers to gathering kai. They continue to express their concerns in a variety of fora. This chapter follows the format of Chapter 5 and discusses:

- patterns of kai consumption;
- estimates of the quantity of kai consumed;
- sites from which kai is gathered;
- preferred kai species;
- perceived changes in the abundance of species;
- kai gathering behaviours;
- perception of the environment;
- health and wellbeing of whanau members; and
- disseminating advice about contamination issues.

6.1.2 Patterns of kai consumption

Data from the 1879-1880 map prepared by Ngai Tahu Kaumatua was discussed in Chapter 5. This manuscript identified sites from which kai was gathered. This manuscript detailed of over 100 resources that were utilised. Analysis of the 1880 manuscript enables us to distinguish the following species sourced in South Canterbury. Of the 38 species identified there were:

- 3 species of shellfish
- 6 species of other freshwater fish
- 7 species of marine fish
- 3 species of birds

- 2 species of sea mammals
- 12 species of plants
- 5 ‘other’ species

Maori who relied directly on their knowledge of lands and rivers within their takiwa for food had access to aquatic species (eels, kanakana, waterfowl), terrestrial species (wild plants, berries, roots, and pollen), and the small game (e.g., rats) that were plentiful and sustained whanau and hapu. Figure 6 showing the location of reserves and easements depicts the scale of loss experienced by Maori following settlement. Historically a surplus of food was gathered as surpluses enabled whanau to access other resources through bartering, trading and gifting (and setting up reciprocal obligations). During the year whanau visited neighbouring hapu, taking surplus food to share. The practice of kai-hau-kai was a central feature of Ngai Tahu culture. Being able to gather abundant foods and thus able to engage in a range of economic practices ensured whanau had access to a variety of foods. Because of trade, however, people weren't restricted to kai immediately available to them from their local area but had access to a wide range of foods. When compared to the range of sites in Figures 4 and 5 it is apparent that Maori were denied access to a significant percentage of their traditional sites of kai gathering across South Canterbury and limited to a number of small reserves and easements located in the lower reaches of streams.

Indeed, many of the valued species gathered historically that were of high nutritional value are no longer available in quantities sufficient to enable them to be a primary food source. As Table 8 confirms most species are seen to be a “lot fewer” in abundance and many iconic species are now only consumed on special occasions. When the perception of species abundance is coupled with the species most commonly gathered in Table 3 and the preferences shown in Table 7, the decline of the eels resource is of particular concern. Sadly as one informant advised, kai is also often purchased for these special occasions – not gathered. Further, the condition of the kai may be compromised as well. Most distressing and representing a significant cultural loss, is the loss of entire species e.g., grayling, koura from some streams, weka.

While whanau made use of many species, the centrality of eels as a critical food source in South Canterbury is well known and reflected in the many initiatives across Te Wai Pounamu to restore populations. As Table 3 shows 72% of sites yielded eels. The current threatened populations of eels, especially longfin, contrasts with their abundance historically. Although some resources were gathered seasonally, historically whanau relied on eel year round.

Food security implies adequate access to affordable, high quality foods that are culturally acceptable. Although Table 3 showed that turnips and potatoes were grown by whanau once they were introduced to the south, this needs to be placed in context. Introduced crops could be grown in the south and a number of cultivations were established.

However, as explained in Chapter 5 introduced aquatic species were not seen as favourably and as the witnesses to the Waitangi Tribunal confirmed, introduced aquatic species were not seen by Ngai Tahu as substitutes of equivalent cultural, spiritual or nutritional value. It was therefore of interest that trout was noted as a preferred species by some respondents in the Kai Consumption Survey.

However if this is the abundant species and requires less catch effort than the declining indigenous species gathered historically, it is inevitable that some substitution occurs. It is clear from our research that whanau currently gather kai at quantities less than they did historically and at quantities less that they desire. This is discussed in the next section.

> *For eels. Full moon or any moon is out then you don't go out. If the moonlight touches the eel then it goes bad before you eat it so we don't go out during moon time.*
>
> *We restrict where we get kai like the wharf area or the outlet for sewage system or Temuka where the old wool scour was or where the settling ponds are because they sometimes overflow so we don't gather there. Or at the site where Temuka dump was we didn't gather.*
>
> *When at moana you don't eat the kai where you gather it and there are sites you avoid.*

6.1.3 Estimates of the quantity of kai consumed

There is little data available to enable calculation of pre-European contact per capita consumption of kai. Even if it was possible to determine harvesting levels for particular species, it is difficult to calculate how much food (and what species) on top of this would have been received as a gift or obtained through trade. For the calculation set out below in Table 10 we have assumed that historically fish would have been consumed on average once per day.

From interviews we know that wild source kai was consumed "at least 3 times" per week up until the 1970s and 1980s. Some whanau, however, eat kai daily. However a crucial time period – around the 1970s and 1980s – marks a significant change in the quantity of kai consumed as interviewees confirmed that more convenience foods

started to appear in whanau diets. Again to enable a calculation of kai consumption in the mid twentieth century we have assumed kai was consumed 3 times per week.

With respect to contemporary consumption, from the Kai Consumption Survey, 90% of respondents still consume kai awa, kai roto, or kai moana. For the comparative analysis in Table 10 we have extracted the quantities of fish consumed from the Kai Consumption Survey data as well as the frequency data (from Figure 25).

Table 10: Estimates of the quantity of kai consumed.

KAI CONSUMPTION HISTORICALLY	KAI CONSUMPTION UP IN TWENTIETH CENTURY 1970S, 1980S	CONTEMPORARY KAI CONSUMPTION
Assumptions • The data for estimating the quantity per sitting is that relating to "fish fillets[8]" • At least one meal of "wild kai" per day per person • Because of the abundance compared to the present, at least 10% more per setting would be compared to today's per sitting estimates 230.77 g per sitting per day Plus 10%	Assumptions • The data for estimating the quantity per sitting is that relating to "fish fillets" • At least 3 meals of "wild kai" per week per person • The quantity per sitting would be the same as today's per sitting estimates of 230.77 g	Assumptions • The data for estimating the quantity per sitting is that relating to "fish fillets" • The quantity per sitting would be the same as today's per sitting estimates of 230.77 g • Special occasions are estimated to be 6 per year. • 9% eat kai on special occasions • 9% eat kai average 2 times per month • 36.4% eat kai once per week • 27.4% eat kai twice per week.
Equals 253.85g per person per day	**Equals 98.90g per person per day**	**Equals 43.81g per person per day. This is higher than the average New Zealand consumption of 32.87g per person per day (Kim and Smith, 2006).**

The quantities for other species are considerably less.

- Contemporary consumption of whitebait — **Equals 7.48g per person per day**
- Contemporary consumption of mussels — **Equals 11.14g per person per day**

The Kai Consumption Survey asked respondents to identify quantities of various types of kai consumed. For the preferred species, as recorded in Table 6 the following observations can be made:

- The quantities available fall far short of levels desired by whanau who wish to engage in mahinga kai practices. The only two species that possibly approach

[8] It is assumed that the "fish fillets" estimate would apply for butterfish, greenbone, kanakana, eels, founder, hapuka, mullet, kahawai, kingfish, gurnard, snapper, moki, shark, trevally and trout.

adequate abundance are mussels and shark which respondents confirmed were available and often sourced from the supermarket or takeaway.

- It can be seen from Table 7 that for almost every species, the majority of respondents believed that populations were declining.

- The majority of kai is now only consumed on special occasions.

6.1.4 Sites at which kai gathering and other activities are undertaken

Major changes in mahinga kai behaviours began some 160 years ago with European settlement. Newly introduced foods replaced wild sourced kai principally because of the relocation of whanau and hapu to reserves, their assimilation in the mainstream New Zealand culture, and damage to the resource base resulting from use and development of resources by the newly arrived settlers. Interestingly many of the sites still utilised by whanau as shown in Figure 30 are found in close proximity to reserves and easements.

Although the initial loss of land occurred in the mid eighteenth century the interviews with whanau members (especially kaumatua) confirmed that they gathered many species until relatively recently and they believed that the most damaging changes occurred within the last generation. These observations confirm the period of 1970-1980 as a time of change.

The alienation of lands and resources has seen the mahinga kai practices of Ngai Tahu transformed. This transformation occurred at a time when resource degradation and environmental crises have precipitated the search for alternatives to dominant management systems (Berkes, 1991, 1994; Pinkerton, 1989; Stevens, 1998). Traditional knowledge, (or in the New Zealand context Matauranga Maori) is increasingly promoted as a valuable addition to scientific knowledge. However it must be recognised that the application of Matauranga has been disrupted and subject to interference. Nevertheless for some whanau, for some resources, in some areas, there has been regular, relatively uninhabited resource use through the generations. As the interviews and Kai Consumption Survey show many Ngai Tahu continue to gather and consume kai awa, kai roto and kai moana.

The fact that kaumatua contend that the most damaging changes have occurred in the current generation, when considered alongside the data showing that the 10% of respondents who don't eat kai are all rangatahi, suggests the assimilation of Maori into mainstream New Zealand lifestyles and diets is continuing. It also suggests that the loss of some mahinga kai practices may be quite marked in younger whanau members.

In South Canterbury, the declining abundance of aquatic species at many sites is attributed to water quantity issues arising because of excessive extractions, changes in flow patterns as a result of damming, and demands to divert or drain waterbodies. This clearly has the potential to place Ngai Tahu in confrontation with development interests as:

- the streams valued and utilised by Ngai Tahu are those most stressed;
- currently 88% of water allocated in Canterbury is used for irrigation; and
- Ngai Tahu believe some of the current land uses (that are totally dependent upon water supply) are unsustainable.

Two graphs from the Canterbury Strategic Water Study (Lincoln Environmental 2002) highlight the concerns of Ngai Tahu. Figure 71 shows that for irrigation, the Orari / Opihi catchment provides 5.7% of the total maximum allocated weekly rate of take. Yet as Figure 72 which follows shows, collectively the Orari and the Opihi represent only 1.3% of Canterbury's surface water resources under low flow conditions.

From Figures 35 to Figures 44 in Chapter 5 it is clear that many of the sites utilised by whanau are found in these catchments. Another more extreme example has the Ashburton providing 19.6% of the total maximum allocated weekly rate of take, while representing only 2.4% of Canterbury's surface water resources under low flow conditions.

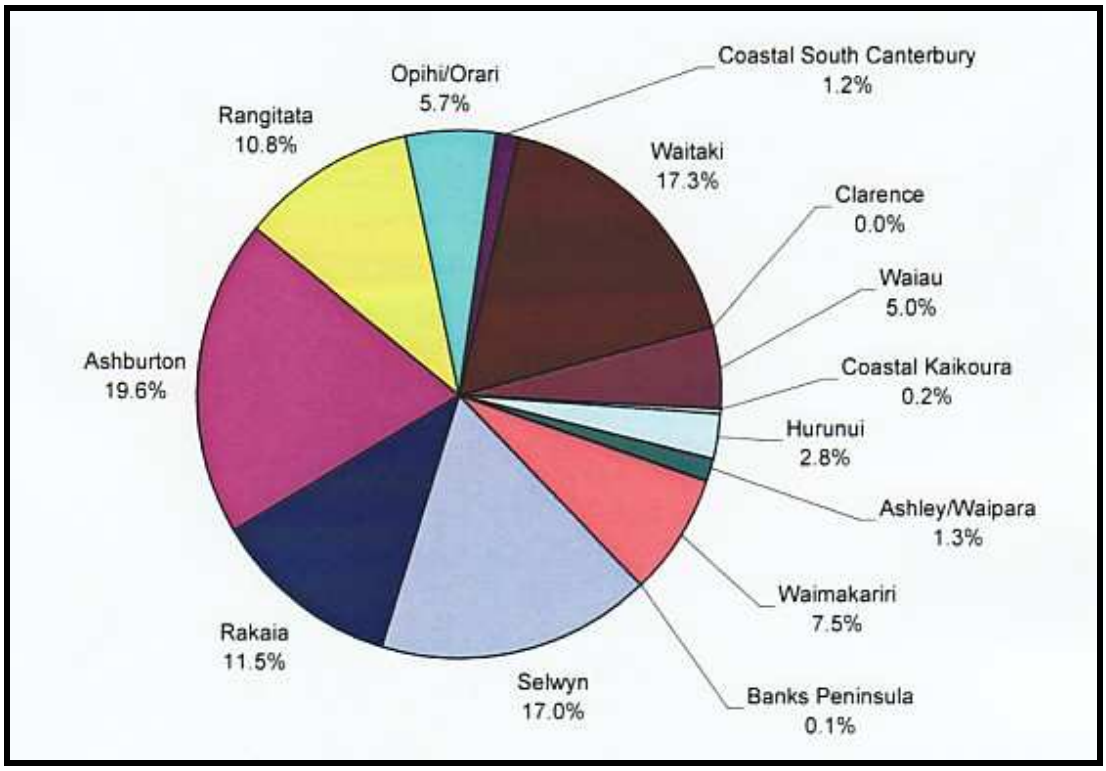


Figure 71: Proportion of total maximum allocated weekly rate of take that is supplied by each of Canterbury's water resource zones (Source: Lincoln Environmental 2002).

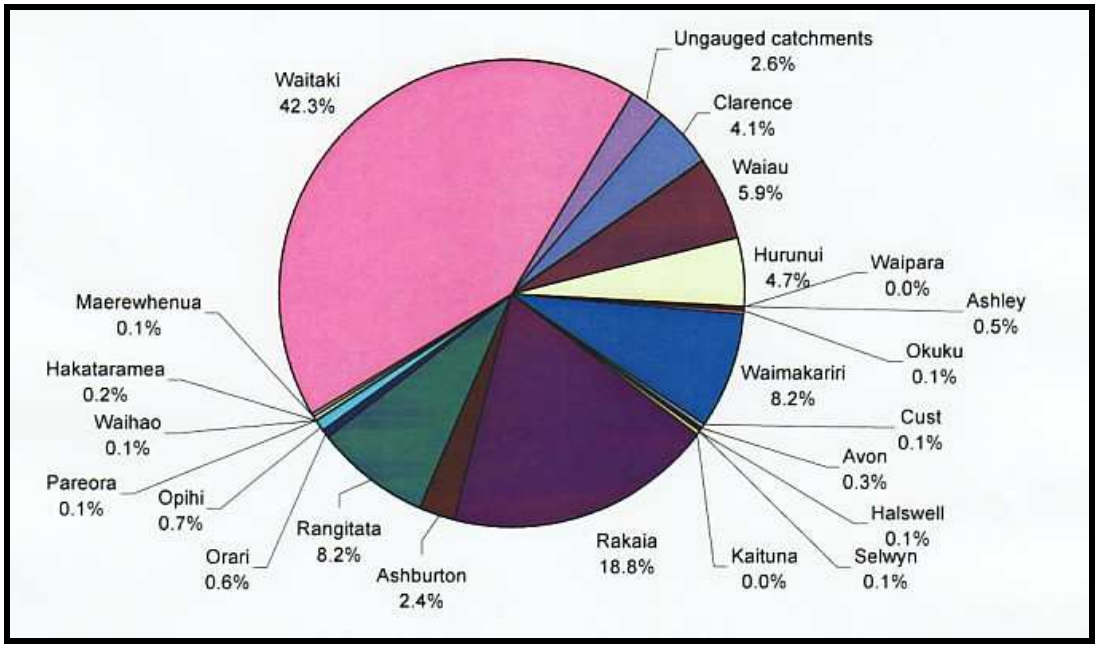


Figure 72: The relative size of Canterbury's surface water resources under low flow conditions (Source: Lincoln Environmental 2002).

While the previous two figures focused on surface water, Table 9 summarises the allocation of groundwater in the respective catchments and also confirms that the smaller catchments used and valued by Ngai Tahu are stressed.

Table 9: Revised Groundwater Allocation Summary[9]. **Issued** = granted consents outside any appeal or objection period. **Decided** = granted consents in the objection or appeal period, and consents that have been objected to or appealed. **In process** = applications for which no decision has yet been made. Total amount of groundwater currently allocated exceeds the allocation limit. Total amount of groundwater currently allocated is 80% of the allocation limit. Total amount of groundwater currently allocated is less than 80% of the allocation limit.

Zone	Allocation limit (million m^3/yr)	Effective allocation (million m^3/yr)				Zone status	
		Issue	Decided	In process	Total	Current & decided	In process
Ashburton River	69.5	69.41	0.00	10.17	79.58	100%	115%
Ashburton-Lyndhurst	126.6	128.79	0.00	8.25	137.03	102%	108%
Fairlie	37.0	4.58	0.00	0.00	4.58	12%	12%
Levels Plain	32.9	24.84	0.24	0.00	25.07	76%	76%
Makikihi	18.05	18.06	0.00	0.00	18.06	100%	100%
Mayfield-Hinds	148	125.68	0.00	5.09	130.77	85%	88%
Orari-Opihi	71.1	71.01	0.00	0.64	71.65	99%	101%
Otaio	4.93	4.76	0.00	0.00	4.76	97%	97%
Pareora	9.38	9.79	0.00	0.54	10.34	104%	110%
Parnassus	12.8	5.49	0.00	0.00	5.49	43%	43%
Rangitata-Orton	42.5	43.99	0.00	2.85	46.84	104%	110%
Valetta	96.6	106.10	0.84	29.41	136.34	110%	141%
Hook	2.49	2.87	0.00	0.80	3.67	115%	148%
Waimate	8.18	7.79	0.00	0.92	8.70	95%	106%

Interviewees believed that summer withdrawals leave some stretches of riverbed almost dry. The water is left dribbling in channels and gets lethally warm and polluted with agricultural runoff. Fish migration – upstream and downstream – is also severely compromised. In some catchments fish survival is dependent on access to isolated and disconnected large pools. Of particular relevance to consideration of contaminant levels, is the reduced assimilative capacity of waterways when only minimum flows are maintained – often for significant periods of time during summer.

[9] Sourced: Environment Canterbury http://ecan.govt.nz/services/online-services/monitoring/groundwater-allocation/Pages/groundwater-allocation-summary.aspx downloaded information was last updated 2 August 2010.

Interviewees expressed concern that both the regional council and Government seem to support and prioritise the beneficial use of water. Water has been allocated for agricultural purposes and these rights are defended vigorously. In contrast, non-agricultural purposes, such as leaving water instream to protect instream values, was and is still designated by some as "wasteful"[10]. From the perspective of Ngai Tahu the prejudice in favour of agricultural usage is still enforced. It is interesting to note that with respect to surface water flows, the following rivers are classified by Environment Canterbury as flow sensitive[11]:

- Opihi
    - Opuha (inflow to the lake).
    - Opihi.
    - Temuka River (Hae Hae Te Moana).
    - Kakahu River (upstream of Hall Road).
    - Tengawai River (whole catchment).
- Otaio – mainstem upstream of Otaio Gorge plus St Andrews Stream.
- Pareora River – catchment upstream of Pareora Huts and Taiko Stream.

Of concern when reviewing Figures 70 and 71, together with the summary of groundwater allocations in Table 9, and the list of flow sensitive surface waters are the catchments that are flow sensitive is hat many appear to be fully allocated or over allocated. To reiterate, all catchments that are valued and utilized as mahinga kai by Ngai Tahu are affected by low flows.

Other evidence to the Waitangi Tribunal by Ngai Tahu describes fish kills in rivers, while interviewees describe changes in the water quality and a deterioration of the condition of kai gathered. Decreased water quality is definitely a cause of denied or limited access to kai. Fertilisers and agricultural pesticides used in agriculture, especially the intensive agriculture of South Canterbury add to the deteriorating water quality. Table 10 summarises current water quality for some of the river used by whanau. Despite these assessments confirming water quality concerns, the waterways in Table 10 are still used by whanau (as shown in Figures 35-44).

[10] Sentiments expressed directly to whanau members – one by a Environment Canterbury staff member but more commonly by agricultural interests.
[11] Flow sensitive is defined in the Natural Resources Regional Plan as "a catchment that is vulnerable to reductions in summer low flows as a result of a change in the vegetation cover from short to tall vegetation.

Table 10: Environment Canterbury monitoring at swimming sites across Canterbury[12].

Catchment	Location	Result
Otaio River	Otaio Gorge	Fair
Opihi River	Saleyards Bridge	Fair
	Temuka River	Fair
	SH 1	Good
	Waipopo Huts	Fair
	Te Moana Gorge	Fair
	Waihi Gorge	Fair
	Lake Opuha – Dam boat ramp	Very good
	Lake Opuha – recreation reserve	Fair
	Lake Opuha – Ewarts Corner	Poor
Orari River	Gorge	Good

More recently Ngai Tahu have been denied access to kai due to increased gathering pressure by ethnic groups who either do not know or respect the tikanga and/or rules that regulate gathering.

In summary the sites still used by whanau are coming under increasing pressure - two types of pressure are being experienced:

- pressure on the use and development of aquatic waterbodies; and
- pressure on the aquatic species themselves.

In South Canterbury this pressure has led to conflict over the extent and impact of resource depletion and degradation.

As whanau explain:

> *Around the Waipopo area, from the Opihi River up, to Pleasant Point we would use the river for eeling, kanakana, floundering, yellow eyed mullet, herring. Around the mouth we would fish for kahawai.*
>
> *Around the Orari mouth we would use it for whitebaiting.*
>
> *Temuka, Opihi area is what we used for eeling. Right the way out to Winchester.*
>
> *Waitarakao was the name of Washdyke Lagoon…. My sister, me and her used to travel around there around gather flounders which used to be in the rocks. We used to gather karengo at certain times of the year on the rocks there. There were also eels taken there and whitebait … Kanakana was a favourite there and it's still there even though the*

[12] Environment Canterbury web page www.Environment Canterbury.govt.nz, downloaded 15 April 2008.

industrial area of Timaru has dumped a lot of its stuff into that area and it's considered polluted. So we don't go there as much now.

6.1.5 Preferred kai species

The principal foods from the Arowhenua archival data were from the main nutritional groups. As Williams (2004) explains:

- Kauru is a carbohydrate (and historically was gathered from 24% of sites).
- Eels are primarily a source of fats, but also sources of protein (gathered from 71% of sites).
- Mata/inaka, waterfowl and the Galaxiids are predominantly protein.
- Forest birds, kiore, kiwi and weka, combine protein and fat.
- Pora was a green vegetable.
- Aruhe was largely a "filler", eaten for bulk, and of low prestige; as was koareare.

Historically whanau and hapu consumed eels and titi as their main sources of fats. These were available in their greatest quantities in late autumn and early winter. Kanakana were a subsidiary source of fat. However South Canterbury was renowned for its kauru. As the main source of carbohydrate, great quantities of kauru were prepared. There is no record that kauru was preserved for consumption at a later date (Williams 2004), although McCallum (2007) describes how it was processed. Tikao describes the confectionaries made from kauru including fruit juices used as flavourings, and a type of jelly made with agar.

In contrast, the data from the Kai Consumption Questionnaire identified the contemporary preferences. Surprisingly, the top 6 according to the ratings (in order of preference) were:

1. snapper, koura.
2. kina.
3. trout.
4. pupu, pipi, cockles, herrings, oysters.

Eels which had been sourced from 71% of sites historically rated only 15th as the preferred food. However this is likely to be a reflection of how difficult they are catch because of their scarcity.

6.1.6 Seasonality of kai gathering

The following figures prepared by Anderson (1983) and Dacker (1990) illustrate the historical seasonal food gathering patterns for the southern region. Although some whanau adhere to these seasonal regimes, the technology (in particular the gear) available to fishers means that resources can be gathered all year round.

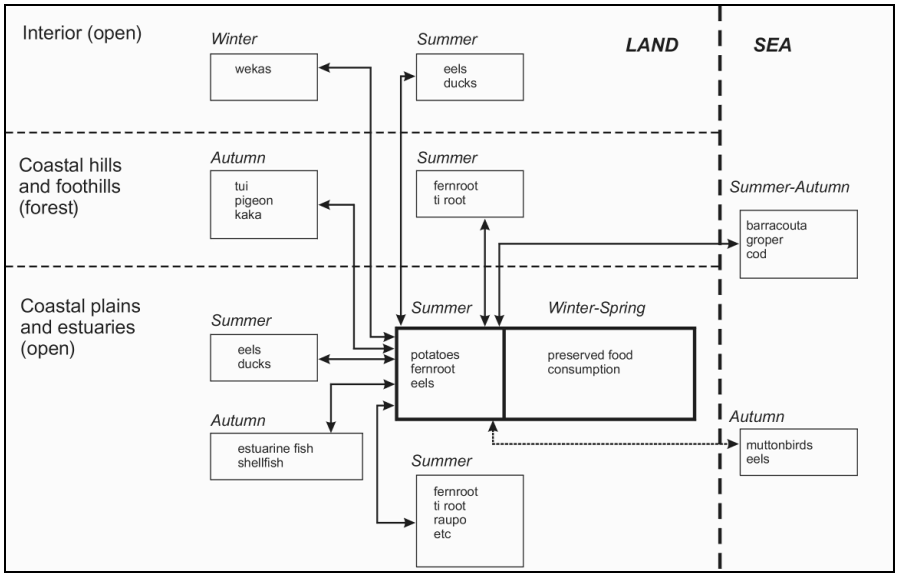


Figure 73: Seasonal Patterns of gathering (extracted from Anderson (1983:43, 1995:117)).

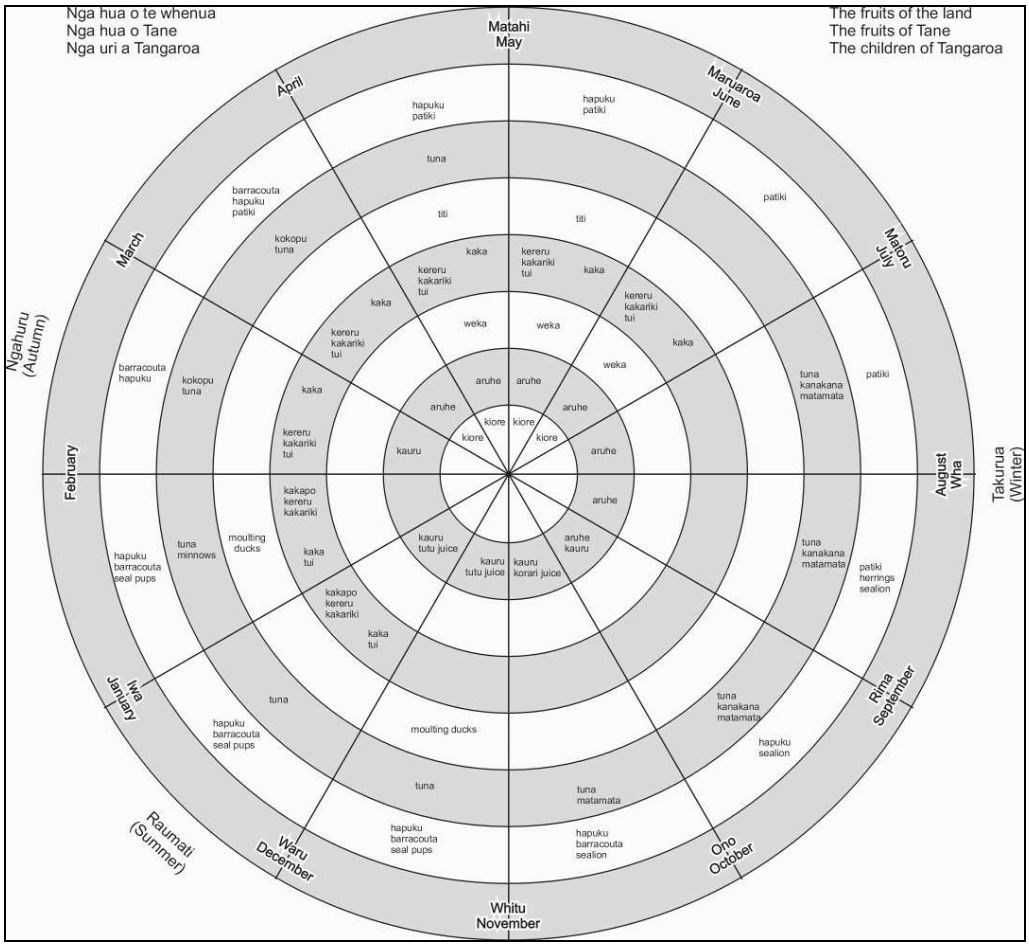


Figure 74: Seasonal Patterns of gathering (extracted from Dacker (1990:10-11).

The following Table has been compiled with the data from the Kai Consumption Survey identifies the seasons when species are gathered today.

Table 11: Seasonal kai gathering patterns today.

Species	Summer	Autumn	Winter	Spring
Herrings	■			■
Lamprey	■	■	■	■
Eel	■	■	■	■
Flounder	■	■	■	■
Paua	■	■	■	■
Mussels	■	■	■	■
Mullet	■			■
Kahawai	■	■		■
Moki	■			■
Shark	■			■
Whitebait				■
Trout	■	■		■
Kina	■	■		■

Key:

■ All the seasons when gathering occurs

■ When the most gathering occurs

Whanau commented -

> *It was all year round because the kai gathered from awa and moana were not supplementary but were essential.*
>
> *Eel have become lesser quantity and hard to get. We believe it's from commercial fisherman and they [eels] are smaller.*
>
> *About twice a year for eels and it really just to see what's there, its information gathering, because I just want to see if it's come back or if its better or if size of eels increased. I went out twice last year and you wouldn't spear as it wasn't big enough and it would be criminal to take. We just had a look around above lagoon to Railway Bridge in a night and it was a sad state of affairs. We hope things will get better.*
>
> *Kanakana is a little different as they are on a migratory thing as they in to breed in the mountains and they don't muck around. Between here and Railway Bridge (Opihi) it's a nights travel so if they come through early in night they will get to the Opihi Bridge and if they come in later then that's where I get them down here and stay in that ground so that why we go out at that time. Same thing at Washdyke they travel that quickly so anything in that line it only has come in that night so hopefully it's not polluted when we gather. Kanakana again it's sad it's hard to get and if you do get one it's a treasured source of food but more than that it good to see they are still there.*
>
> *Watercress is seasonal is usually goes with the frost but there are some spots under the willows.*

6.1.7 Processing of these preferred species

The processing of kai species also needs to be understood if all possible pathways of contaminants are to be identified. In this section only two species are discussed and the means of processing described.

1. Eels were often preserved as pawhera eels. The skin, backbones, heads and tails were removed and the eels hung out to dry. Curing them like this preserves them for months. For eating, they are softened by steaming. This process is called "pawhera". After this the eels are partly cooked and again dried. Flesh treated in this way could be stored for three years.

2. Titi (mutton birds) have long been an important food for Ngai Tahu, especially southern Maori who have control of the birding rights. Titi is a prized food. Once the chicks are collected, they are plucked and then the feet and wings are cut off. They are then dipped in wax to help remove the layer of down on the bird's body. Once hardened, the wax is cracked and removed, taking the down with it.

- "Poha titi" refers to the process of preserving the birds, whereby the hot fat retained from cooking the birds is poured into a kelp bag or kete and allowed to set, the flesh of the birds inside the pōhā is preserved for a very long time.
- Another method of processing is for the birds to be packed in salt and placed in buckets for shipping to whanau or to markets on the mainland.

Whanau also explained -

River and creeks used in that for rotten corn as well as fermenting spuds. We used to put them in there and brought them out and the smell was very strong.

They [tuna] were the main staple of our diet. Getting eel to supplement the table….. putting them in the deep freezer for the winter.

Anyway bring home tuna and clean it up myself.… I smoke some of mine and some I boil up in pot with watercress. The Maori boys showed me how to cook eels with watercress.

6.1.8 Perceived changes in the abundance of species that are gathered

A number of questions on the kai consumption survey sought to determine of the reasons for the dietary changes. The quantitative data summarised in Table 7 suggest the declining abundance of aquatic species in rivers is one of the main causes of diet change. However interviewees also reported degradation of aquatic environments, loss of access as a result of land tenure change, societal change (more specifically working longer hours) and government regulation as barriers to their engagement in mahinga kai activities.

Whanau were able to identify changes to different species -

A species that disappeared from when we were younger is koura. You would be lucky to see one. When we were young we would play in the creeks right down to the pa and we would take them home in jars. We can blame it on pollution in the Temuka River and they don't like that.

Amount of white baiters and the river systems have altered and the breeding ground along the side where they traditionally laid there eggs is just not there anymore and that's major reason.

Farming has changed this with drains being cleared out and the native grasses on edges are gone from banks and all you have now is a stream running through shingle.

For eel to gather half a dozen in half an hour and same with mussels back then. 10 mins on a reef there you would get enough.

When I went out early this year to get eel we went out at 8 pm to 2 in morning we only got 5 eels. Before you would have got that in 1 hour. Had to travel quite a bit to find them and the river has changed a lot since back then with a lot less water and there used to be a lot of holes where you could fish from but now you don't see that.

Loss of the numbers of eel and it's from commercial eeling because we used to find a lot of nets down river and we used to cut them up and let them go. And they got cunning and we can't find them now.

We don't seem to get the bigger eels. Four inches around anymore with them being a lot smaller now. Six of them used to be enough but with the size now you probably need 12 of them to get a decent feed.

6.1.9 Kai gathering – its contribution to wellbeing

The concept of mahinga kai extends beyond the nutritional value of species and its physical health benefits to encompass a range of cultural values. It describes species available locally and encompasses the cultural values attributed by whanau and hapu to these species as each is gathered, processed and distributed according to tikanga and kawa. Some of these values are discussed, albeit briefly, in the paragraphs below.

Whakapapa - Whakapapa is an important conceptualisation for Maori. Whakapapa is also central to kai gathering, which like many other cultural activities, is built around collective action (Ireson 1992, 1996). This is highlighted in South Canterbury where rights of manawhenua determine access to reserves and fishing easements.

Whanaungatanga - Kai gathering afforded opportunities for whanaungatanga bringing whanau together and enabling values and information to be transmitted from one generation to the next. A central tenet of whanaungatanga is to care for kaumatua and those unable to gather for themselves. After kai is gathered it is eaten together in groups of family and friends. It is therefore apparent that social capital built up through kai gathering could be more beneficial than those derived from more cotemporary individualistic activities, such as pataka. The development of these initiatives appears to draw upon these notions of social capital for cultural legitimacy.

Wairuatanga - Ngai Tahu and other Maori use different ways to feel spiritually connected with their takiwa. Gathering kai with whanau at a traditional fishing place, that they know was named by their tupuna and utilised by successive generations of their whanau, is one way. Being able to contribute the kai that their takiwa is renowned for, to ceremonies like kai-hau-kai[13] and to manaaki manuhiri can also bring that connection.

[13] Kaihaukai (Williams 2004) suggests breaking down the word kaihaukai into its component parts - *kai* (food); *hau* (obligation outstanding); kaihau ("Acquire property without payment or return made"

Manaakitanga - Although Durie (2004) contends that mauriora is dependent upon a secure cultural identity, diet changes can lead to loss of culture and identity. Having the ability to manaaki visitors by supplying kai sourced from one's takiwa means that the activities of fishing, eeling and gathering other foods creates and maintains community ties and reinforces identity. Conversely the inability to manaaki guests and sustain whanaungatanga can lead to cultural loss.

Matauranga Maori - As has been previously stated, the activities of gathering and preparing kai serves the functions of passing on traditional knowledge from one generation to the next. Matauranga Maori is developed and transmitted through practices of food management, harvesting and preparation. A great deal of knowledge is needed in order to obtain kai - knowledge of techniques and also knowledge of ecosystems. If populations of aquatic species do not return, knowledge of the techniques of gathering these foods along with the associated ecological and cultural knowledge and the process of gathering will likely also begin to disappear. Knowledge of preparation is also important. Yet as food species disappear from the dining table, the particular knowledge of how prepare foods is also lost.

Te Reo - That kai is instrumental to a culture is reflected in the stories and Te Reo that pertain to food. Te Reo contains knowledge and is an expression of culture and identity. Te Reo has been declining for many reasons, one of which may be attributed, in part, to changing lifestyles. When a valued species disappears from a local ecosystem, or the activities associated with a species decrease, the associated Te Reo drops out of usage. When 92% of the respondents confirmed that they would stop gathering if advised that species and sites were contaminated, the indirect cultural impacts that would ensue could represent a significant loss.

Cultural survival - This section has attempted to describe how kai gathering is the glue that binds whanau, hapu and community together, providing a sense of identity that also serves as the vehicle for the transmission of values and knowledge. Mahinga kai probably received more recent attention than any other tribal issue in the Ngai Tahu claim. Archived documents, including evidence previously cited in this report, provides in-depth testimony concerning the cultural and spiritual significance of aquatic kai species and of the water bodies across South Canterbury themselves. If contaminants lead to a further reduction in kai gathering, which is arguably at the heart of Ngai Tahu culture, at stake is nothing less than Ngai Tahu cultural survival.

Williams (1983:87)). Therefore kaihaukai, describes a feast which obligates those who received the feast to reciprocate. Williams (2004) explains that the kaihaukai was rather more complicated than as it was a form of trading, as there was a distribution of surplus food.

Hauora Maori - The presence of kaumatua represents "intellectual capital". They are holders of a wealth of critical information about the past and can draw on this knowledge to provide accurate assessments of environmental condition, including changes over time, at a localised level. The results from the Kai Consumption Survey confirm that differences in behaviours, perceptions and knowledge are found with the different generations. Loss of relationships with the natural world could lead to grief. Many feel whakama when unable to fulfil the social roles expected of their age groups. At stake with the loss of kai gathering is not only cultural survival, but potentially the physical and mental wellbeing of whanau members. The comments of whanau members support the statements above.

> *We learnt that from our mother and she learnt off her grandmother and we have passed it on.*
>
> *Anywhere we were taught to get kai was from mother and this became less and less as she had a great knowledge of what was safe in her head and what wasn't and we follow this.*
>
> *Kai is shared with whanau and extended whanau. If you have anymore than you need you would share. It's such a rarity to get kanakana that you first think of giving it to your elders. This has always been our way with giving away your first lot.*
>
> *Tuna was our staple. Temuka was renowned for tuna… Today there is nothing there in comparison. In those days the quantity there was more than enough and to share with visitors and today we have barely enough for ourselves let along share with our visitors which isn't good.*
>
> *…mainly taught by grandmother and grandfather they show you want to do.*
>
> *Always part of life we were brought up with it. I would love to give the same amount of attention to these areas and have them for my children when they grow up but with the lack of places to do what we want to do like eeling and catching kanakana the environment is not there. Then the whole process of teaching your children the same knowledge from parents and grandparents disappears as well. The whole community feeling of Maoridom goes as well.*
>
> *My children are in Christchurch and they would love to learn and I would love to teach them and they are getting less chance to learn. There is a lot of whanau around us and the younger generations are moving away from the marae and they are not coming back to the rivers and moana to get the food which we gathered with supermarkets being cheaper for them.*
>
> *It mainly for table.… I don't just go and get it for the sake of getting it. I would rather have it fresh.*

We always share what we get with family or with visitors from Christchurch and we would give them some to take away. Always been like that.

First to the kaumatua. That is a practice always it still down now. Even now with watercress and that's done regularly.

We had areas where we went to gather kai and you would see others (whanau). I am one of the only few kaumatua who gather kai. Though some kaumatua may get kai given to them from there whanau. Those practices still going on with some times I walk out and I see a bucket of cockles. This year alone I have had ducks, Canadian goose, cockles and paua.

The difference between now and then there was a need to put kai on the table because it was traditional it didn't matter how far you went. Sometimes it was on a horse and cart and it became a whole day thing. You all went out and gathered. … But that is all gone now. There is not a need now. But we need to exercise our customary rights. There is a perception out there that the river belongs to the trout. One of the main things when talking to Fish and Game. In the past there were eel drives where they would put them up on the banks and let them rot. This was to protect the trout.….

6.1.10 Perception of the environment

Questions sought information from interviewees about how they perceived:

- the abundance of kai species;
- the condition of sites from which kai is sourced;
- the changes to their gathering behaviours; and
- barriers to gathering.

The results in relation to the first three dot points have been discussed in the previous paragraphs. With respect to the perceived barriers, the results show that opinions varied. The results are collated and listed below, and complemented by the quotes of interviewees where appropriate.

Government and council actions acting as barriers

- Need for authorisation, permits and licenses before gathering – that restricts quantities to be gathered and the seasons of gathering.

- Introduction of the Quota Management System (QMS) for highly valued species (e.g., eels) and as a result commercial over-harvesting threatens populations.

- Mismanagement of waters, lands and resources by regional and district councils.

- Lack of any management input by Maori over lands, waters and resources.

- Lack of support to undertake stock assessments of valued species and if necessary implement restorative programmes.

- Redefinition of the customary right to a "non-commercial" right thus preventing restoration of bartering and trade.

Mahinga kai gathering is no longer able to be undertaken according to tikanga. Over time the cumulative effect of settlement and government regulation changed both the circumstances and practice of kai gathering, with both the river environments and the fisheries impacted. Many whanau no longer live in the catchment, kai is not their livelihood, and kai no longer their staple diet. Regulation tries to dictate what they gather, where they gather, and when they gather. But this knowledge – what, how and when - is the basis of matauranga – the knowledge that Ngai Tahu are supposed to possess. In other words the changing face of mahinga kai as a result of regulation also led to the practices, decision-making and knowledge generating processes associated with mahinga kai being changed or alienated from many Ngai Tahu resource users.

Environmental problems acting as barriers - South Canterbury has been heavily impacted by agricultural development and to a lesser extent urban and industrial development. Informants voiced their concerns at environmental conditions which they argued kept them from gathering kai:

- Sewage/contaminants from septic tanks, town sewerage schemes.

- Scarcity/limited availability of resources.

- Over-harvesting of resources.

- Intensification of agricultural land uses.

- Run off from farmland, especially from dairy farms.

- Discharges from industry e.g., scours mills, freezing works.

Land tenure change - Without doubt land loss alienated many whanau and hapu from mahinga kai gathering:

- Private land – many of the lands across South Canterbury were taken up by settlers by the late 1860s.
- Inability to gather on DOC lands.
- Recreational hunters/fishers gaining prominence.
- QMS instituting a property rights regime.
- Locked gates on private property limits access.

The most densely settled areas in South Canterbury are along the coastal margin while the river valleys that are ecologically productive and previously supported intensive mahinga kai usage, now sustain intensive agriculture.

Lack of Traditional Knowledge creating barriers - The practice of mahinga kai represents generations of learning and teachings about places, the resources they yield and the methods of gathering and processing resources. Internationally there are ongoing discussions about the loss or erosion of traditional knowledge as indigenous communities become more integrated into regional or national economies (Inglis 1993, Berkes 1994). It is recognized, however, that it is important to differentiate, between situations where matauranga held by hapu and whanau is adapting to new environments and economic conditions and where matauranga is being lost due to a disruption of its transmission.

But to understand ecological knowledge one must participate in the processes of hunting, fishing, gathering and processing of kai. In other words whanau with a history of use and those who continue to use waterways and resources are those that retain and continue to generate the matauranga. In this way, directly or indirectly, the whanau is the main perpetuator of the Ngai Tahu way of life and stories.

The data sourced from rangatahi suggest that they are experiencing the consequences of the loss of knowledge generation processes, while the comments of pakeke suggest they are losing the opportunities to teach. It is encouraging, however, that not all this knowledge is lost and given the opportunity, would be able to flourish in a re-invigorated cultural context.

As whanau explained –

Watercress you have to go upriver to get decent looking watercress because below the bridge you still got that backwater coming back it must build up and still come back and you can taste it. But up river the waters still flowing through and even the trout still taste better than below the bridge.

I go to the Orari if I want to catch some flounders as the river is free flowing.

Mouth open running straight should be….. It should be straight out so it can come in and then out to clean it out.

I have taken an eel from a good drain toward Clandeboye. It was a old haunt there. But I didn't eat it as it smelt of cow dung and I never went there again.

The things destroying the river are 4wd and motorbikes. They think it's a big deal to drive up the riverbed but they don't know what they are destroying.

They have put the price of rubbish dump up and what people are doing now are they are dumping along the riverbank now. It's a council issue.

I believe there are health risks because of practices over the years like the wool scour. We don't know what chemicals are going in and what that is doing to the watercress and the tuna. The other one that worried me were the timber mills around the area and I am always suspicious of the chemical they are using.

6.1.11 Health and wellbeing of whanau members – the mixed methods and contradictions

Toxic contamination and the resultant health impact on humans has received considerable research attention over the past three decades (Edelstein, 1988; Freudenberg, 1984; Perrow, 1984). This research seeks to explore the potential health consequences of the changing kai gathering behaviours sourced by whanau and hapu in order to determine the ongoing risk of exposure to contaminants.

Ngai Tahu continue to be dependent upon kai gathering both physically and culturally. Mahinga kai was the primary food source and the basis of an economy based on trade, barter and exchange. The transition from wild sourced kai which in the case of South Canterbury numbered more than 30 species to a western style of diet comprising commodity/convenience foods consequently impacted Ngai Tahu socially, culturally, economically and spiritually.

Physical health - Physical health is directly linked to the quantity and quality of food consumed, as well as the cultural, social and economic conditions within which individuals live. In the context of this research programme, physical health consequences arise from four factors:

1. changes in the nutritional value of foods consumed today compared to their traditional diet;
2. being denied access to gather also affects health by limiting the physical exercise associated with the act of gathering;
3. the risk of contamination of kai that is consumed;
4. the risk of contamination from the sites that kai is gathered from.

The loss of access and use of traditional resources is now recognised as being a contributor to a change to a western style of diet and the consequent rise in diet related illnesses which from an economic perspective could cost society. However the converse is also of concern as for those whanau who still gather kai there is a risk of exposure to contaminants from eating wild sourced kai.

An important health benefit of kai gathering results from the act of gathering itself – an activity that requires physical activity. The importance of exercise to general physical health is widely recognised. Traditionally Maori got a lot of exercise in the course of gathering kai. Although the amount of exercise that whanau get now as a result of gathering has declined, those surveyed reported engaging in some activity, although the frequency of such activity has declined as gathering behaviours have changed. However, it cannot be assumed that all gathering will be beneficial as the physical act of gathering resources could expose whanau to health risks as the sites where gathering occurs, specifically the waters and sediments, could be contaminated. The levels of contaminants in kai gathered and the environments in which they are found, will be reported separately. In addition, models describing possible risk to tangata whenua will be developed as part of the risk assessment and communication component of this project.

Wellbeing - The benefits derived from being in natural settings are also gaining increased recognition (Kaplan & Kaplan 1977, 1982). In addition to the data on diseases within the family (using data obtained from the Kai Consumption Survey), the interviewees described the broader social, economic and cultural impacts resulting from the changing patterns of kai gathering and consumption on their wellbeing – as individuals, as whanau and as a collective. The comments of informants describe the contribution of gathering and eating kai on wellbeing.

6.2 Implications for future management

The results of the Kai Consumption Survey show that the gathering and consumption of kai awa, kai roto and kai moana is highly complex. This is in terms of both the differences in availability of kai awa, kai roto and kai moana between hapu, the diversity of aquatic habitats, and the diversity within and between whanau. There is some indication that consumption levels are also related to the quality of kai awa, kai roto and kai moana that is available and the quality of aquatic ecosystems that they come into contact with when gathering. These results enable us to make a number of observations with respect to future management.

Sites from which kai is gathered - Where and when people gather kai is a function of the location of their work, the proximity of waterbodies, and other activities of a whanau. This is supported by Garaway (2005) who argues in relation to fishing that it is almost always combined with other activities. The Kai Consumption Survey confirmed that whanau are likely to go fishing in a nearby lake or stream thus reducing the time spent travelling between areas of work, home and collecting. For Ngai Tahu this means gathering from the lowland reaches of streams that are some of the most degraded in Canterbury. While many of the scenically attractive braided rivers of Canterbury attract attention from environmental organisations seeking their protection, it will be interesting to see who in the community, aside from Te Runanga o Arowhenua, will put their hand up to protect the many small waterbodies that support kai gathering.

Preferred kai species consumed - Knowing the preferences of whanau is essential if restoration initiatives are to target the priorities of whanau and hapu. If resources available for such initiatives continue to be limited, targeting funds to priorities is inevitable. A related concern that emerges when whanau do identify their preferences is that there are very few surveys undertaken to determine a "population baseline". Without this information it is difficult to determine what a sustainable level of customary harvest is.

Perceived changes in the abundance of species - If Maori are interacting with aquatic ecosystems on a regular basis they are ideally placed to observe changes – to sites and to species. Guidance is needed to ensure that their observations are part of a structured and robustly designed perception study so that they are not to have their observations dismissed as being "anecdotal". However, the challenge will be that few agencies support perception based assessments – let alone prove that a species is at risk and in need of management intervention.

Kai gathering behaviours - There is a complex mosaic of uses and users of aquatic resources within a takiwa that collectively shape the livelihoods of whanau and hapu. Kai gathering cannot be classified as one activity. Instead, they are part of a complex combination of activities for a range of members in a household. As the survey shows whanau hunt, and tend fruit and vegetable gardens. The effort afforded to gather kai is not a homogenous activity – it is a flexible activity that is undertaken by different people, at different times, targeting different species from different waterbodies using a range of equipment. Collectively this confirms a complex relationship between humans and their environment. It is important that information continues to be collected to increase our understanding of these range of behaviours, including their aspirations.

Disseminating advice about contamination issues - Furgal (1999) and Grondin and Carron (1999) argue that we need to consider both formal and informal networks when it comes to the circulation of information. Data from the Kai Consumption Survey confirms the need for formal and informal networks and suggests that advice could be provided by Health Protection Officers and Environmental Protection Officers, Maori Health Workers and whanau members.

While Maori have been active in developing relationships with resource management agencies, formalised relationships with the parties that can undertake the research necessary to understand contamination issues and deliver the messages, may need to be developed**.**

7. The next steps in the research process

Maori are faced with a "Catch-22" – whanau and hapu want to continue to undertake cultural activities, such as kai gathering, that they contend are central to "who they are". However because of the risk of exposure to contaminants, these same cultural activities could be the cause (and not the cure) of some of the ills being experienced by whanau and hapu.

This report has shown how looking beyond simple representations, such as consumption, reveals the complex and diverse role of both kai awa, kai roto and kai moana in the behaviours of whanau and hapu. Further, kai awa, kai roto and kai moana are accessed in diverse and complex ways.

The results from the Kaimoana Consumption Survey clearly support the statements found in archival records, and as articulated to the Waitangi Tribunal in 1989-1990 that kai awa, kai roto and kai moana are vitally important to whanau and hapu in South Canterbury. It appears that, consistent with the cultural values of whanaungatanga and manaakitanga, there is significant distribution of kai outside of whanau. For hapu, kai awa, kai roto and kai moana continues to represent a food source upon which all members of a hapu can subsist if the health and abundance of species and the condition of valued sites are assured.

Kai awa, kai roto and kai moana are also represented in terms of their wider social and cultural importance. Being able to maanaki visitors and provide kai sourced from your takiwa remains of fundamental importance. Other forms of provision, such as purchasing kai and / or having it supplied through systems such as pataka, have drawn on the social and cultural values associated with gathering kai awa, kai roto and kai moana to be legitimised within both Maori and government institutional planning. Arguably the outcome is that kai awa, kai roto and kai moana threatens to be reduced to 'availability' and species is increasingly becoming synonymous with supply from commercial fishers rather than customary gathering.

7.1 Next steps

Using the site specific data and the species data that resulted from the Kai Consumption Survey, the next stage of the research will identify the types and levels of contaminants present in the "wild kai" and associated habitats identified by Maori.

The analyses that are proposed at the next stage will then enable the researchers to establish potential pathways of contaminant bioaccumulation via the food web. This information will then be available to whanau from Te Runanga o Arowhenua.

7.2 Disseminating advice about contamination issues

> *Communicating the risks of environmental contaminants in the food chain to northern Aboriginal peoples poses significant challenges for communities at risk and environment and health professionals alike..… communication practice on this issue include increased fear and confusion in northern communities, changes in the dietary behaviour and traditional lifestyles of their residents, and associated impacts on their society, economy, and health. … The importance of this information is increasing as research begins to detect subtle health effects from exposure to these substances among newborns in some northern regions. Thus planning and evaluation are needed for risk communication, and possibly changes to the scale at which communication work is done in northern communities.* Furgal et al., (2004).

Frugal (2003a) contends that some of the challenges associated with communicating contamination risks are unique to the specific issue and the context of communities. This chapter has repeatedly stressed the contradictions or the Catch 22 that Ngai Tahu find themselves as a result of trying to balance two potentially conflicting perspectives:

1. the health and wellbeing benefits that results from the continuing practice of gathering kai or conversely the impacts that arise when changing from a traditional lifestyle and diet; and
2. the adverse impacts on health and wellbeing arising from contamination of aquatic ecosystems and the potentially the kai species themselves.

The cultural comprehension of what is “risky” behaviour is complex. Maori, like those in other indigenous communities, have limited experience with food safety issues similar to that of contaminants in foods they gather.

Understanding how indigenous communities perceive contaminants, has significant impacts on the reception and effect of messages delivered. Usher et al., (1995) contend that communities may distrust the information they receive about contaminants in foods and their distrust could affect their reception of further explanations or clarifications. Furgal et al., (2003a) found that concerns over contaminants was not a determinant of food choice in one Labrador community, yet Kuhnlein et al., (2003) reported that 42% of women interviewed in five western Arctic communities indicated “concern over contaminants” as a reason why they did not serve more foods to their families. The objective of this research is to effectively

convey to Maori the risk of gathering kai. Overseas research indicates a number of aspects need to be addressed.

The advice to be delivered - A minimal amount of work has been undertaken to identify the types of messages that elicit certain or desired responses. Usher et al., (1995) indicates that good messages are direct, simple, not condescending, put in a personal context, accurate, translated into local languages, delivered early and often, and build upon local understandings and knowledge of the issue.

Materials to be presented - Numerous forms of materials have been used to communicate messages on contaminants and country food in North America including posters, fact sheets, reports, pamphlets, personal letters, radio public service announcements, radio call-in shows, regional video programs, door-to-door or face-to face communication, community meetings, school curriculum materials, and national live television broadcasts (Furgal et al., 2003b). From the Kai Consumption Survey we know that a range of media are likely to be needed.

Delivering the advice - To be effective a message has to be distributed through pathways that ensure it will reach and engage the target audience - in this instance, hapu members who gather kai. Furgal (1999) and Grondin and Carron (1999), in their work with northern hemisphere communities, identified the need to consider both formal and informal pathways of delivery and information circulation. Data from the Kai Consumption Survey confirms the need for formal and informal networks and suggests that advice could be provided by:

Formal networks:	Health Protection Officers and Environmental Protection Officers
	Maori Health Workers.
Informal networks	Whanau members

Specificity - Vaughan (1995) and Slovic (2000) contend that personal experience, gender, age, socioeconomic status, and profession influence perceptions of risk. Understanding how Ngai Tahu see the issue is critical to ensure that the communication is best oriented towards their understandings and perspectives.

McGrath (2003) argues for a relationship based approach to exchanging knowledge on issues such as contaminants within and between communities. This will require scientists and communicators to understand the informal paths of information flow in communities so they can develop mechanisms that support and utilise these pathways to communicate information about contaminants.

> *One might argue that little true "communication" on the issues of contaminants, food, and health has taken place between scientists, health professionals, and Aboriginal residents in many northern communities; rather, a great deal of scientific information has simply been disseminated* Leiss (1997:29).

Understanding and developing ways to better communicate information on contaminants and their impacts on health is critical. Reports of contamination can undermine confidence of whanau in their environment and gathering of resources as a source of individual and collective well-being.

As whanau explain -

> *All we have is speculative information about kai. If we had scientific information about what's in our kai and the area of where we are gathering kai if it could dangerous then we would make decisions about that.*
>
> *As long as area is clean then it's no problem. Going back to the lagoon it's a big risk to eat from there. I don't know anyone being sick from it. But it would be silly to eat anything from there because you can see the water before you get there.*
>
> *I wish they would do something about the river here. It's getting worse every year. Since the dam has been up we have never had a real flood to clean out river. We have just had a lot of rain and you should smell the lagoon now it smells nice and fresh. It washed the river through. You need that fresh water to clean the river. I may go down to the Opihi this year since there has been a fresh going through it.*

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Tribunal Evidence

J:10, H:1, H:10, H:47, H:49, F:11, P:15(a).

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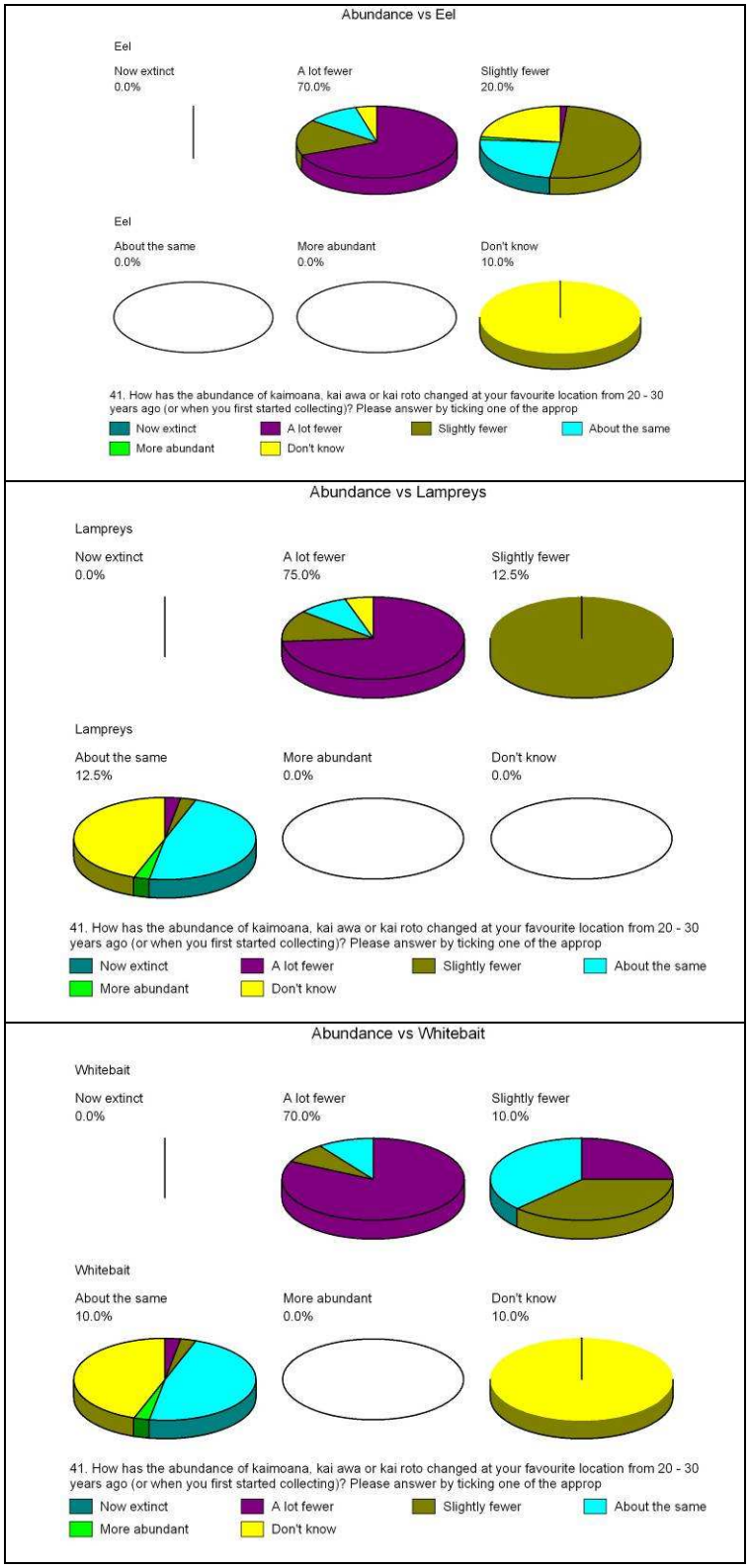
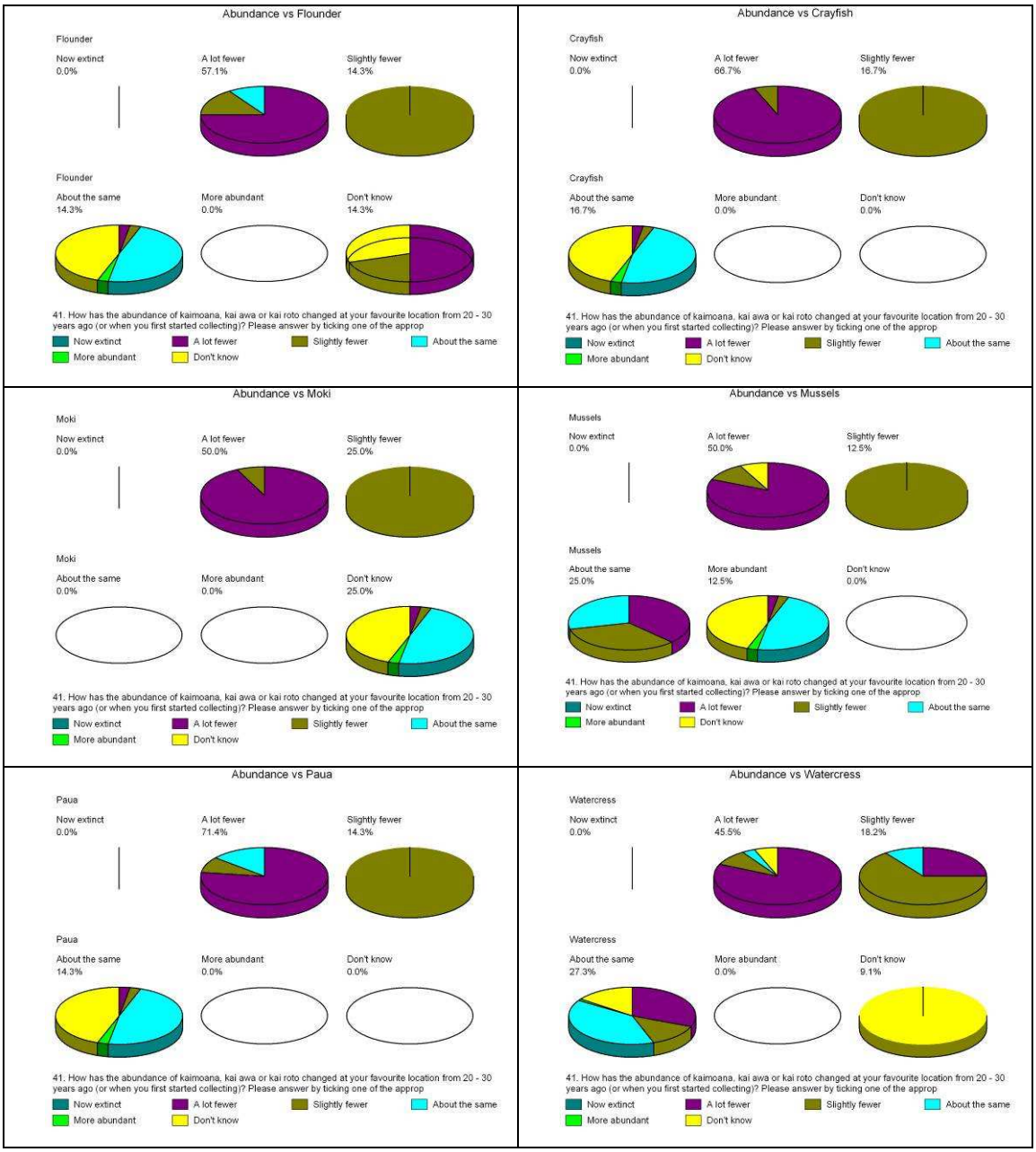
10. Appendix 1: Perceived changes in abundance of species




Abundance vs Flounder
Flounder
Now extinct 0.0%
A lot fewer 57.1%
Slightly fewer 14.3%
Flounder
About the same 14.3%
More abundant 0.0%
Don't know 14.3%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know
Abundance vs Crayfish
Crayfish
Now extinct 0.0%
A lot fewer 66.7%
Slightly fewer 16.7%
Crayfish
About the same 16.7%
More abundant 0.0%
Don't know 0.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know
Abundance vs Moki
Moki
Now extinct 0.0%
A lot fewer 50.0%
Slightly fewer 25.0%
Moki
About the same 0.0%
More abundant 0.0%
Don't know 25.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know
Abundance vs Mussels
Mussels
Now extinct 0.0%
A lot fewer 50.0%
Slightly fewer 12.5%
Mussels
About the same 25.0%
More abundant 12.5%
Don't know 0.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know
Abundance vs Paua
Paua
Now extinct 0.0%
A lot fewer 71.4%
Slightly fewer 14.3%
Paua
About the same 14.3%
More abundant 0.0%
Don't know 0.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know
Abundance vs Watercress
Watercress
Now extinct 0.0%
A lot fewer 45.5%
Slightly fewer 18.2%
Watercress
About the same 27.3%
More abundant 0.0%
Don't know 9.1%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

11. Appendix 2: Sites and species identified by iwi participants (number of respondents)

Kai	Opihi River upstream of SH bridge	Opihi River below SH bridge	Opihi River Mouth	Orari River Upstream of SH bridge	Orari River Mouth	Ohapi Creek	Temuka River	Waihi River	Te Hae Hae Te Moana	Jacks Point	Washdyke	Otaio River	TOTAL	Other
Watercress	6	7	3	3	4	2	5	3	2				**35**	Awarua (x3), Temuka, Te Umukaha
Eel	7	4	3	2	2	2	5	3	3	1	1	1	**34**	Te Umukaha
Trout	5	3	2	1	2	1	5	2	1	1	1	1	**25**	Te Umukaha
Whitebait	1	4	6		3		3				2		**19**	
Flounder	1	2	5	1	2		2			1	3		**17**	
Herrings		2	3	1	1					1	1		**9**	
Lampreys	1	1	1		1		2	1			1		**8**	Waihao
Mussels										5	1		**6**	Timaru (x2), Teaitaraki, Jacks Point, Moeraki
Kahawai			2		1					1			**4**	Teaitaraki
Mullet		1	1							1	1		**4**	Teaitaraki
Oysters										1	2	1	**4**	Patiti Point, Bluff
Shark			2							1			**3**	Moana
Puha							3						**3**	Temuka, Te Umukaha, Awarua (x2), all over
Paua										3			**3**	Teaitaraki, Jacks Point, Moeraki
Seaweed										1	1		**2**	Wales
Crayfish										1			**1**	Kaikoura, Teaitaraki (x2), Moeraki
Kina										1			**1**	Teaitaraki
Muttonbirds													**0**	Titi Island (x3), Papatea
Cockles													**0**	Warrington, Karetane
Freshwater mussels													**0**	Pareora (x2)
Tuatua													**0**	Teaitaraki
Freshwater crays													**0**	Pareora (x2)
Greenbone													**0**	Papatea, Bluff
Toheroa													**0**	Oreti
Pupu													**0**	Moeraki
Hapuka													**0**	Moana
Kingfish													**0**	Nelson
Snapper													**0**	North Island
Moki													**0**	Timaru
Tarakihi													**0**	Timaru
Trevally													**0**	Timaru

A survey of wild kai consumption in the Arowhenua rohe

NIWA Client Report: HAM2010-098
August 2010

NIWA Project: HRC08201

A survey of wild kai consumption in the Arowhenua rohe

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Contents

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Executive Summary

Waterbodies impacted by pollution and suffering environmental degradation represent a risk to the health of both aquatic organisms and humans. Even at low concentrations contaminants, particularly organic compounds, can cause long-term impacts and pose significant risks to the health of biota and humans. Human health may be threatened either by the consumption of food (especially fish and shellfish) contaminated with pollutants, or by direct exposure (via water and atmosphere during collection) to them (Boesch and Paul 2001). This research, funded by the New Zealand Health Research Council over a three year period, ultimately aims to improve Maori health by identifying, quantifying, and effectively communicating the risks associated with the collection and consumption of wild kai.

Wild kai, gathered from the sea, rivers, and lakes, has always been an integral component of Maori lifestyles, but today is increasingly susceptible to contamination. The impacts of environmental contamination in wild kai on Maori have not been investigated to date. The present research sought to address this shortcoming. As part of the first phase of the research, Maori from three communities were asked to identify species, locations and quantities of kai moana, kai roto and kai awa consumed. This was to enable the levels and types of contaminants in the kai to which Maori are exposed to be determined, and pathways of potential contaminant uptake by tangata whenua investigated by analyzing relevant food-chain components.

Three Maori communities were involved in this research: Te Arawa: centred around the Te Arawa / Rotorua Lakes and Maketu coastal area; Ngāti Hokopu ki Hokowhitu: centred around Whakatane; and Te Runanga o Arowhenua: centred on South Canterbury. The three communities differ in their access to and use of aquatic resources. Each community is characterised by different physical, natural, social and political capital which directly impacts on the level of kai awa, kai roto and kai moana gathered and consumed. In each region the diversity of aquatic ecosystems utilised, with spatial and temporal patterns of gathering unique to the each place and community, reflect a history of complex, locally specific tikanga and kawa driven behaviours. Exploring the complexity of this inter-community variation was beyond the scope of this research.

This report documents the results of the first phase of the above research programme, specifically investigating the level of kai consumed by members of Te Runanga o Arowhenua, whose whanau have resided in South Canterbury for centuries. For centuries the rivers, streams, wetlands, lakes and hapua have also been the mainstay of their economy providing freshwater fish, shellfish, waterfowl, and plants.

With respect to the research design drawing on the earlier work of Bebbington (1999), importance of kai to whanau was examined using standard interview techniques according to:

- the instrumental role – the significance of rivers, lakes and coastal environments as a source of physical health (specifically nourishment); and

- the hermeneutic role - the ways in which kai awa, kai roto and kai moana give meaning to the lives of whanau and hapu. Contemporary research seldom examines the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana, which when communicated to policy makers in the absence of empirical data, are often dismissed as anecdotal. Finally, kai awa, kai roto and kai moana (and the waterbodies from which they are sourced) are examined in terms of their cultural embeddedness of whanau and hapu.

All of those interviewed for this research expressed a strong relationship with the lakes the wider terrestrial and marine surroundings. Whakapapa, ancestral connection to the lakes area and ahi karoa remain significant elements of the relationship. Two thirds of the participants spent their childhood in South Canterbury (within the takiwa of Te Runanga o Arowhenua) while two of the participants grew up in the North Island.

A large variety of kai continues to be regularly collected, gifted, purchased and/or consumed. While whanau continue to gather a range of species, it is considerably less than the 38 species that we know from manuscripts were historically obtained from these sites across South Canterbury. Although some resources were gathered seasonally, historically whanau relied on freshwater resources year round. The principal purpose of the Kai Consumption Survey was to determine the extent of gathering by whanau living in the South Canterbury region. Consistent with a kai gathering lifestyle:

- 78.5% grew their own vegetables.

- Of the 78.5%, 57% of those who grew vegetables also grew fruit.

Having determined that all of respondents do consume different types of kai:

- 40% of respondents said they now only eat kai on special occasions; while

- 18.9% eat kai less than once a month; and

- 22.3% eat kai 1-3 times per month.

In other words 81.2% eat kai 1-3 times per month or less.

In addition to identifying the species gathered, the sites from which kai was sourced were identified. These sites were then used as the basis for a sampling programme which examined contaminants in sediment and kai. Kai was gathered from 13 waterbodies across the region. Approximately 47% of

participants gather from the Temuka River, while the Opihi River (upstream of State Highway 1, downstream of the State Highway, and the river mouth) is used by 30%, 28% and 37% respectively.

If kai moana, kai awa and kai roto are to be promoted as a beneficial source of food for whanau, there need to be sufficient quantities of healthy stocks in order to sustain gathering. Questions in the Kai Consumption Survey asked whanau to provide their assessment of the stocks of various species gathered. Of concern, 54% of respondents believed that across all species gathered there were now a "lot fewer" available while another 17.9% believed that abundance was "slightly fewer".

Whanau were asked to identify their preferred kai. Surprisingly, the top 6 preferences according to the ratings (in order of preference) were:

1. snapper, koura
2. kina
3. trout
4. pupu, pipi, cockles, herrings, oysters.

There is little data available to enable calculation of pre-European contact per capita consumption of kai. Even if it was possible to determine harvesting levels for particular species, it is difficult to calculate how much food (and what species) on top of this would have been received as a gift or obtained through trade. For the calculation we assumed that historically wild sourced kai would have been consumed on average once per day. From interviews we know that wild sourced kai was consumed "at least 3 times" per week in the 1970s and 1980s. Some whanau, however, eat kai daily. However a crucial time period – around the 1970s and 1980s – marks a significant change in the quantity of kai consumed as interviewees confirmed that more convenience foods started to appear in whanau diets. From the interviews this coincides with observable deteriorations in the health of aquatic habitats. Again to enable a calculation of kai consumption in the mid twentieth century we have assumed kai was consumed 3 times per week.

With respect to contemporary consumption, from the Kai Consumption Survey, all respondents still consume kai awa, kai roto, or kai moana. The quantities available fall far short of historic levels and the levels desired by whanau who wish to engage in mahinga kai practices, although they exceed average New Zealand consumption rates (32.87g per person per day).

Kai consumed historically	Equals 230.77 per person per day
Kai consumed up until 1970s &1980s	Equals 98.63g per person per day
Kai consumed today	Equals 43.81g per person per day

Part of the reduction in quantities consumed can be attributed to environmental degradation. A species will show signs of dwindling for a while and then suddenly decline because its population is no longer self-sustaining.

Major changes in mahinga kai gathering behaviours began some 160 years ago with European settlement. Newly introduced foods replaced wild sourced kai principally because of the relocation of whanau and hapu to reserves, their assimilation into mainstream New Zealand culture, and damage to the resource base resulting from use and development of resources by the newly arrived settlers. Interestingly many of the sites still utilised by whanau are found in close proximity to reserves and easements.

Although the initial loss of land occurred in the mid eighteenth century the interviews with whanau members (especially kaumatua) confirmed that they gathered many species until relatively recently and they believed that the most damaging changes occurred within the last generation. These observations confirm the period of 1970-1980 as a time of change.

The alienation of lands and resources has seen the mahinga kai practices of Ngai Tahu transformed. This transformation occurred at a time when resource degradation and environmental crises have precipitated the search for alternatives to dominant management systems (Berkes, 1991, 1994; Pinkerton, 1989). Traditional knowledge (or in the New Zealand context Matauranga Maori) is increasingly promoted as a valuable addition to scientific knowledge. However it must be recognised that the application of Matauranga has been disrupted and subject to interference. Nevertheless for some whanau, for some resources, in some areas, there has been regular, relatively uninhabited resource use through the generations. As the interviews and Kai Consumption Survey show many Ngai Tahu continue to gather and consume kai awa, kai roto and kai moana.

The fact that kaumatua contend that the most damaging changes have occurred in the current generation when considered alongside the data showing that the 10% of respondents who don't eat kai are all rangatahi suggests the assimilation of Maori into mainstream New Zealand lifestyles and diets is continuing and that the loss of some mahinga kai practices may be quite marked in younger whanau members.

In South Canterbury, the declining abundance of aquatic species at many sites across Canterbury is attributed to water quantity issues arising because of excessive extractions, changes in flow patterns as a result of damming, and demands to divert or drain waterbodies. This clearly has the potential to place Ngai Tahu in confrontation with development interests as:

- The streams valued and utilised by Ngai Tahu are those most stressed.
- Currently 88% of water allocated in Canterbury is used for irrigation.
- Ngai Tahu believe some of the current land uses (that are totally dependent upon water supply) are unsustainable.

Interviewees believed that summer withdrawals leave some stretches of riverbed almost dry. The water is left dribbling in channels and gets lethally warm and polluted with agricultural runoff. Fish migration – upstream and downstream – is also severely compromised. In some catchments fish

survival is dependent on access to isolated and disconnected large pools. Of particular relevance to consideration of contaminant levels, is the reduced assimilative capacity of waterways when only minimum flows are maintained – often for significant periods of time during summer.

More recently Ngai Tahu have been denied access to kai due to increased gathering pressure by ethnic groups who either do not know or respect the tikanga and/or rules that regulate gathering.

Despite the level of environmental change and the potential for contamination, it needs to be acknowledged that lifestyles today leave little time for fishing activities.

Changes to the health of the waterbodies and consequently the relationship of whanau with aquatic resources have resulted in a range of health and wellbeing implications for Ngai Tahu whanui. Although the implications emerge from the data they are quite subtle with some informants describing the effects without explicitly "labelling" it as an effect. However, despite this, the links between aquatic resources and health and wellbeing are evident in the sense that they are 'just below the surface' for many of the participants. It is possible that because the themes presented are widespread amongst the interviewees they are also widespread amongst the rest of the hapū, especially the older members who have experienced a lot more of the changes presented in this report first-hand.

1. Introduction

1.1 Background

Waterbodies impacted by pollution and suffering environmental degradation represent a risk to the health of both aquatic organisms and humans. Even at low concentrations contaminants, particularly organic compounds, can cause long-term impacts and pose significant risks to the health of biota and humans. In the aquatic environment, contaminants transported by the air and in the water are highly likely to be deposited in sediments, where in turn, fish and shellfish are exposed. Contaminants are generally stored in the lipids of biota and can be biomagnified up the food-chain. Human health may be threatened either by the direct consumption of fish and shellfish contaminated with pollutants, or by direct exposure (via water and atmosphere during collection) to them (Boesch and Paul 2001).

Concerns about the potential accumulation of contaminants in fish and other wildlife, which commonly form a component of indigenous peoples' diets, and their consequent potential effects on human health, has led to a worldwide proliferation of studies examining the effect of environmental contaminants on fish, wildlife and communities. For example, leading international indigenous contaminant research programmes, e.g., the Northern Contaminants Programme (NCP) and the Effects on Aboriginals from the Great Lakes Environment (EAGLE) Project were established in response to concerns regarding the exposure of humans to elevated levels of contaminants in the traditional subsistence diets of indigenous peoples. Research to date has shown that certain indigenous communities have elevated contaminant levels due to exposure through their traditional diet (Hoekstra et al., 2005; Johansen et al., 2004; Odland et al., 2003; Van Oostdam et al., 1999; Van Oostdam et al., 2003). In addition, fish and wildlife are used as indicators of the health of the ecosystems.

The impact of environmental contamination on the resident "wild kai", and in turn, on Māori iwi/hapū consuming them, has not been investigated to date. A recent review of wild food in New Zealand identified gaps in knowledge of contaminants in non-commercial wild-caught foods, especially in terms of consumption levels (and hence exposure) (Turner et al., 2005). A resulting draft position paper identified a need for information and education on contaminants in kai (NZFSA 2005). In response, the National Institute for Water and Atmospheric Research (NIWA), in conjunction with Tipa & Associates and iwi research partners, Ngāti Hokopu ki Hokowhitu, Te Arawa Lakes Trust and Te Runanga o Arowhenua initiated a programme of research to investigate the contaminant levels and risk to Maori health associated with 'wild kai' – food gathered from the sea (kai moana), rivers (kai awa), and lakes (kai roto). This research, funded by the Health Research Council over a three year period, ultimately

aims to improve Maori health by identifying, quantifying, and effectively communicating the risks associated with the collection and consumption of wild kai.

1.2 Research Rationale

Traditionally, Maori had their own knowledge systems of how the environment contributed to health and well-being. Wild kai, gathered from the sea, rivers, and lakes, has always been an integral component of Maori lifestyles, but today is increasingly susceptible to contamination. The impacts of environmental contamination in wild kai on Maori have not been investigated to date. The present research sought to address this shortcoming.

As part of the first phase of the research, Maori from three communities were asked to identify species, locations and quantities of kai moana, kai roto and kai awa consumed. This was to enable the levels and types of contaminants in the kai to which Maori are exposed to be determined.

While it could be argued that contamination of wild kai has the potential to directly impact the physical health of Maori, the impacts of contamination and/or loss of an important cultural activity on wellbeing have also been explored during the course of the project. Maori associate their well-being as individuals and as members of whanau, hapu and iwi, with maintaining the health of the natural environment (Durie 1994, 1998, Panelli and Tipa 2007, 2008). Maori strongly believe that the whenua and tangata are inextricably intertwined, and when one of these becomes unbalanced, the other equally suffers (Harmsworth and Warmenhoven 2002; Sims and Thompson-Fawcett 2002). Therefore, the sustainability of the natural environment and the long-term well-being of Maori are seen by some Maori as one and the same thing (Panelli and Tipa 2007). This is consistent with conceptualisation of wellbeing proposed by other indigenous communities (Adelson 2000, Greiner et al., 2005, McLennan 2003, McLennan and Khavarpour 2004, McGregor et al., 2003). Customary and recreationally gathered "wild kai" resources are therefore of significant cultural, recreational and economic importance in both traditional and contemporary Maori society (Waitangi Tribunal 1983, 1984, 1987, 1988, 1989, 1991, 1992, 1995, 1998)[1].

The majority of the international research in the area of contaminants in the traditional diets of indigenous peoples has primarily focused on the levels and health effects of exposure to heavy metals and organochlorine contaminants through the consumption of marine fish and mammals in peoples from the northern hemisphere, i.e., the Inuit people of northern Alaska, Canada and Greenland (Hoekstra et al., 2005; Johansen et

[1] The evidence submitted to the Tribunal by Iwi, and the summary reports from the Tribunal itself provide a graphic depiction of the significance of gathering kai for whanau, hapu and iwi.

al., 2004; Odland et al., 2003; Van Oostdam et al., 1999). Research to date has shown that certain Inuit communities have elevated contaminant levels (e.g., mercury, lead and chlordane) due to exposure through their traditional diet (Van Oostdam et al., 2003).

It is unlikely that contemporary Maori communities have been exposed through their diet of "wild kai" to the levels of organochlorine contaminants as high as those observed in indigenous populations residing in the northern hemisphere (due to occurrence of large mammals in the customary diet of Inuit). However, the impact of environmental contamination on the resident "wild kai" and, in turn, on Māori iwi and hapu consuming them, has not been investigated to date. In addition, while existing consumptive advice is available for some species of relevance to Māori, this advice is based on average national consumptive patterns and doesn't account for potentially higher consumption rates of specific traditionally harvested foods by Māori, with its concomitant elevated exposure risk. Māori utilise kai from rivers, lakes and the oceans (as well as the land).

This research aims to identify and communicate the risks posed by the presence of environmental contaminants in the kai moana, kai roto and kai awa to the Maori communities that gather these resources. Major outcomes of the research will be development of a generically applicable risk assessment framework, and Maori-targeted risk communication strategies. It is envisaged that the research will be of interest to the wider Maori community, non-Maori, public health providers, as well as indigenous peoples worldwide for whom fish and shellfish constitute a major part of their diets.

1.3 Research aim

The overall aim of our research project is:

> *To determine to what extent locally available kai moana, kai roto, kai awa, and the associated aquatic environments pose a health risk to tangata whenua.*

Successful frameworks for undertaking research in a manner that is culturally acceptable, and which ensures the protection of intellectual property rights, were developed between NIWA and Ngāti Hokopu and Te Arawa during the HRC and FRST funded programmes 'The Revitalisation and Enhancement of Matauranga Hauora of Aquatic Environments (C01X0226)' and 'Sustainability and Management Framework for Te Arawa Lakes' Customary Fisheries (CO1X0305)'.

Memoranda of Understanding between NIWA and Ngāti Hokopu ki Hokowhitu, Te Arawa and Te Runanga o Arowhenua have been established to formally record the expectations of conduct between NIWA and the respective parties with respect to the present research.

Three Maori communities were involved in the overall research:

- Te Arawa: centred around the Rotorua Lakes;
- Ngāti Hokopu ki Hokowhitu: centred around Whakatane; and
- Te Runanga o Arowhenua: centred on South Canterbury.

These communities were selected on the basis of previous contact (and research projects underway) with key researchers. Permission was obtained and confirmed by a sub-contractual agreement.

The three communities differ in their access to and use of aquatic resources. Each community is characterised by different physical, natural, social and political capital which directly impacts the level of kai awa, kai roto and kai moana gathered and consumed. In each region the diversity of aquatic ecosystems utilised, with spatial and temporal patterns of gathering unique to the each place and community, reflect a history of complex, locally specific tikanga and kawa driven behaviours. Exploring the complexity of this inter-community variation was beyond the scope of this research.

There are four main stages to the research project:

1. Objective 1: The first stage involves interviews with key informants and undertaking a survey to identify what kai moana species are harvested and eaten by iwi/hapu members from Ngāti Hokopu, Te Arawa and Te Runanga o Arowhenua, and the aquatic environments they are currently sourced from.

2. Objective 2: The second stage identifies the types and levels of contaminants present in the “wild kai” and associated habitats identified by Maori.

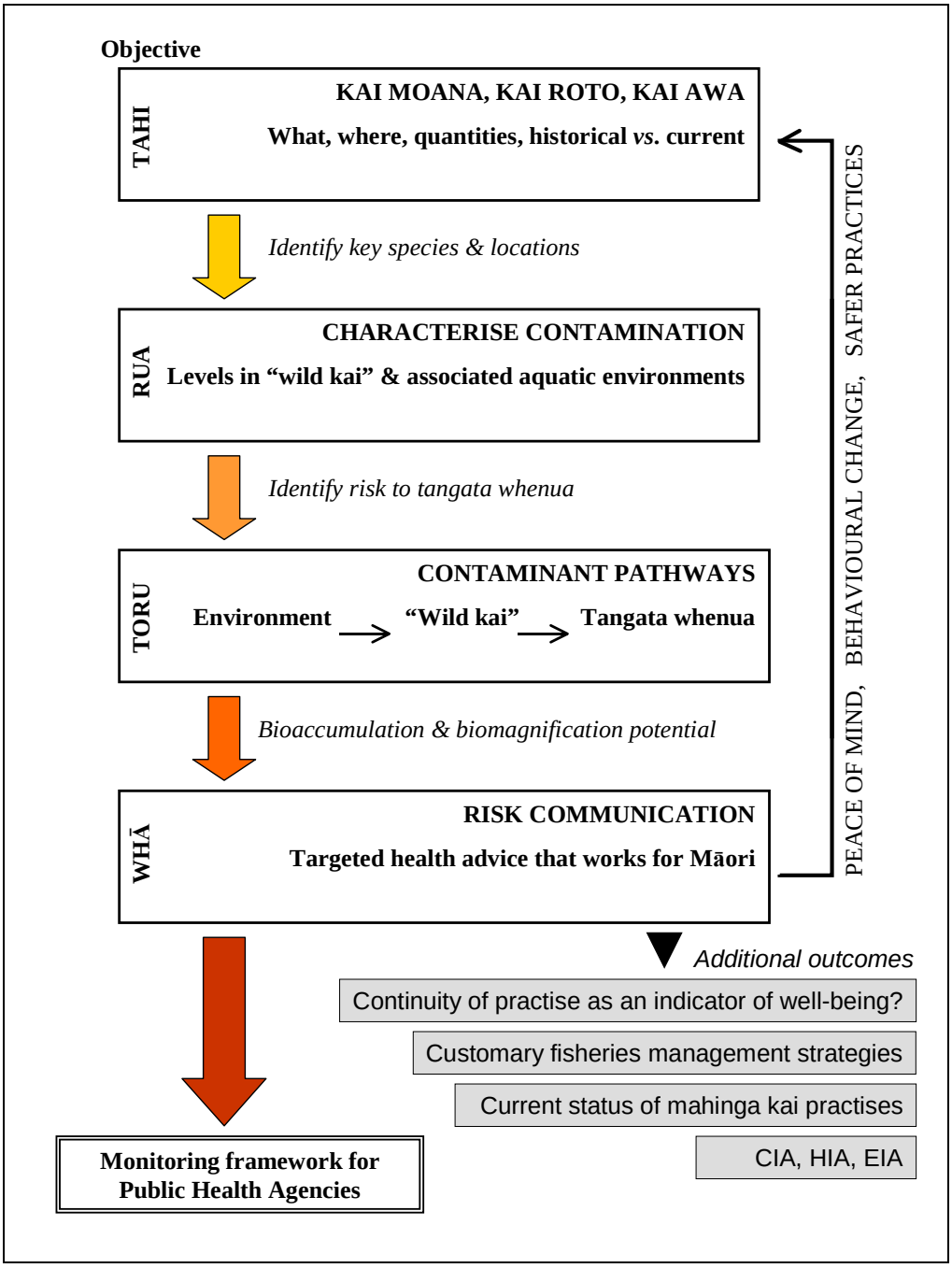
3. Objective 3: This stage establishes potential pathways of contaminant bioaccumulation via the food web utilising methyl mercury as an example of a bioaccumulative contaminant.

4. Objective 4: This stage identifies the potential health risks associated with the collection and consumption of contaminated “wild kai”, and develops risk

consumption advice specifically targeted at Maori, that will take into consideration both the benefits and risks associated with eating kai moana, kai roto and kai awa.

Figure 1 provides a graphic representation of the identified research priorities, the objectives, and possible outputs.

Figure 1: Research priorities, the objectives, and possible outputs.



The first objective of the research (to provide a description of the kai moana, kai roto and kai awa collection, processing and consumption patterns of iwi/hapu members) is clearly a precursor to Objectives 2–4. This first stage identifies:

- What types of kai have been collected and/or eaten in the last 2–3 generations (e.g., species, life-stage, abundance)?
- Where were/are they harvested from and when (e.g., location, ecosystem, season, time of day, life-stage)?
- How is kai moana stored and processed for consumption?

This report documents the results of the first phase of the above research programme, specifically investigating the level of kai consumed by whanau in South Canterbury and the potential effects of environmental contamination on their physical, spiritual and cultural well being.

To elicit the data needed we included methods that have been used previously with hapu around New Zealand. This approach consisted of focus groups and hui, followed by interviews. For this objective it was important to assemble a group of willing participants with knowledge and experience of kai gathering in the takiwa (area) and rohe.

1.4 Report Structure

This report has been divided into a number of sections:

Section 1 Sets out the background and the aims of this study.

Section 2 Describes the methodology that was used.

Section 3 Provides some information on Te Runanga of Arowhenua and their takiwa in South Canterbury region.

Section 4 Outlines international developments within which the research is situated, specifically:

4.1 indigenous communities and participatory approaches to management and research;

4.2 contemporary wellbeing research, and implications for this study;

4.3 international observations of the impact of changing diets;

4.4 effects of contaminants on health;

4.5 Maori conceptualisations of health and wellbeing.

Section 5 Introduces the empirical analysis by outlining the quantitative research results; specifically with respect to contemporary patterns of gathering. This chapter is informed by the Kaimoana Consumption Survey.

Section 6 Based on the results, develops a broader understanding of the importance of kai awa, kai roto and kai moana within the wider socio-economic-cultural activities of whanau and hapu. It provides a brief comparative analysis by discussing the contemporary patterns alongside historic traditional patterns. It pulls together the qualitative and quantitative research results and identifies main themes that are then discussed in the context of international literature.

Section 7 Returns to the original kaupapa of the research and discusses the next steps in the research process. The report concludes with observations of how social, cultural and political meaning associated with kai gathering could inform the management of such resources within the community.

5.1 historic, traditional patterns of gathering;

5.2 changes to traditional lifestyles; and

5.3 contemporary patterns of gathering.

Section 6 Then moves away from presenting the quantitative results to develop a broader understanding of the importance of kai awa, kai roto and kai moana within the wider socio-economic-cultural activities of whanau and hapu. It reflects and pulls together the qualitative and quantitative research results in the context of international literature.

Section 7 Returns to the original kaupapa of the research and discusses the next steps in the research process. The report concludes with observations of how social, cultural and political meaning associated with kai gathering could inform the management of such resources within the community.

2. Methodology and Data Analysis

There is growing recognition of the significance of aquatic habitats and the resources found within them that sustain indigenous communities. Yet this recognition has not been accompanied by investigations to increase understanding of the specific contribution of aquatic habitats and resources to the health and wellbeing of communities depending on these resources.

Drawing on the earlier work of Bebbington (1999), importance to whanau was examined according to:

- the instrumental role – the significance of rivers, lakes and coastal environments as a source of physical health (specifically nourishment); and

- the hermeneutic role - the ways in which kai awa, kai roto and kai moana give meaning to the lives of whanau and hapu. Contemporary research seldom examines the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana, which when communicated to policy makers in the absence of empirical data, are often dismissed as anecdotal. Finally, kai awa, kai roto and kai moana (and the waterbodies from which they are sourced) are examined in terms of their cultural embeddedness of whanau and hapu.

This section of the report outlines the methodology employed, but starts with a description of the Maori community studied.

2.1 Study area

As previously stated, this report details the results of one case study: Te Runanga o Arowhenua. Participants living in South Canterbury were recruited from Te Runanga o Arowhenua members. Availability to take part in the research was the only exclusion criteria, although the preference was for key informants to be active kai gatherers. The study was undertaken under Ethics Approval MEC/07/07/088 and all participants gave written informed consent.

2.2 Methodology

The research team utilised two research methodologies to contrast the instrumental and hermeneutic role of aquatic resources as a source of kai awa, kai roto and kai moana. The first was a quantitative survey of wild kai consumption using a questionnaire, while the second incorporated participatory research techniques via a focus group and a series of qualitative interviews.

The survey followed once the interviews were complete. This was to ensure that the sites and species about which data was sought in the questionnaire were identified by the hapu, and not predetermined by researchers.

2.3 Quantitative survey - Kaimoana consumption survey

The Kaimoana Consumption Survey questionnaire was adapted from a range of other studies (including diet surveys, fish consumption surveys, traditional use surveys, surveys of the health of indigenous communities and perception/preference surveys). The survey questionnaire was approved as part of the Ethics Committee approval process.

2.3.1 Kaimoana consumption: quantifying importance of sites and species

We examined consumption using a food frequency questionnaire with frequency categories ranging from less than once per month to one or more times per day. Consumption is one of the principal means by which the importance of kai awa, kai roto and kai moana and the intimate and dependent relationship with aquatic environments from which they are sourced can be determined.

2.3.2 Existing estimates

Kaimoana consumption records in New Zealand are sparse. Estimates were derived using data from the questionnaire by calculating the amount consumed and the frequency of consumption.

2.3.3 Seasonal variation

Some species of kai awa, kai roto and kai moana are seasonal resources while others are open access. Seasonality is explained in historical literature recognising that tikanga and kawa was attuned and responsive to the life-cycle of the different species. Therefore, questions in the survey identified where possible seasonal patterns of contemporary gathering.

2.3.4 The impact of kai awa, kai roto and kai moana on whanau and hapu livelihoods

Arguably there is a need for a broader understanding of the importance of aquatic resources as a source of kai beyond the simplistic statements of mahinga kai that often accompanies ecologically based descriptions of aquatic ecosystems. The questionnaire sought to address this need by analysing the complex relationship that whanau have with waterbodies found in their takiwa.

2.3.5 Other

Other data gathered included:

1. demographic information, such as the prevalence of certain medical conditions, lifestyle factors including risk-related behaviours, and family history;

2. self-reported heath status using a generic, health-related quality of life questions;

3. kai gathering locations; and

4. perceptions held by whanau members about the importance of aquatic ecosystems and species, and their assessment of the health of these resources.

2.4 Qualitative methods

The qualitative methods used here address the first of the research objectives as stated in Section 1.3 above. Methods involved an introductory hui, a focus group session, follow-up interviews, informal discussions with many people and reviewing secondary data sources (documents).

2.4.1 Literature review

An examination of relevant literature was undertaken for five reasons

1. to provide a more comprehensive understanding of historical resource use and patterns of activity in the study community;

2. to gain an appreciation of the changes to the aquatic habitats over time, as perceived by participants;

3. to identify the changes over successive generations that have impacted on kai gathering behaviours;

4. to understand the aspirations of Te Runanga o Arowhenua to address issues of concern with respect to waterbodies; and

5. finally, to ascertain if and how agencies have responded to the stated aspirations of participants.

Qualitative data were collected from published and unpublished documents, from libraries, the Waitangi Tribunal (evidence to the Tribunal and reports from the Tribunal), statutory and iwi plans, and statutory planning documents. Internet searches also yielded further material.

2.4.2 Participatory methods

Before working with Te Runanga o Arowhenua, an introductory presentation was given at a monthly runanga meeting during which the participatory process was outlined. Two participatory methods were incorporated into the research: a focus group and interviews with key informants. At the start of all interactions (focus group and interviews) the roles and obligations of participants and researchers were discussed.

Focus group

A focus group was convened at Temuka in April 2008. Seven participants attended the focus group. The participants were engaged in a guided discussion lasting 1–1.5 hours. The focus group followed the framework of questions presented in Box 1. This second session focused on gaining a broad understanding of the spatial extent and description of aquatic resources from which kai awa, kai roto and kai moana were sourced, and the overall importance of each waterbody and species to whanau and hapu. Maps were used to record information about species, locations and other relevant information. Discussions of the focus group were taped.

In depth semi-structured interviews

In the weeks following the focus group meetings, follow-up interviews were conducted. The purpose of these interviews was to collect additional and more detailed data related to the location and types of kai collected and consumed, and factors that may have influenced gathering. Interviews also covered preparation technologies and processes, and specifics about consumption. The questions used for the focus group were also used to guide the interviews that probed more deeply into the personal experiences, thoughts and feelings of the individuals. The intention was to identify and explore the diversity and complexity of relationships and gain a comprehensive understanding of the changes to aquatic environments and the emergent issues seen as potentially impacting health and wellbeing as perceived by different individuals. Interviews were carried out with 10 individuals resident in South Canterbury. Each interviewee was identified by Te Runanga o Arowhenua.

BOX 1: QUESTIONS AT THE FOCUS GROUP & INTERVIEWS

Species of kai

- What (species of kai) did you gather when you were young?
- What places can you remember visiting to gather kai when you were growing up?
- Did you collect year round or seasonally?
- Can you recall any places that you were told not to go to for kai?
- Were there any times / occasions that you were unable to gather kai?
- How long did it take to gather the kai that you needed?
- What (species of) kai do you gather today? What places do you use today?
- Do you gather kai year round or is it seasonal?
- What events / conditions etc. stop you from gathering kai?
- How often would you or someone in your whanau go out to gather kai?
- How long does it take to gather kai compared to when you were younger?
- What species / sites have you lost over the years? When and why did you stop using them?

Behaviours with kai

- Is kai shared? With whom? Has this changed over your lifetime?
- How was kai prepared? Has this changed?
- What methods are used to collect kai? Has this changed?

Condition of kai

- What quantities were taken when you were younger? What quantities are taken today?
- What was the condition of the kai when you are younger? How does this compare with what is taken today?

Observed and known changes

- What changes to the experience of gathering kai h you observed? How has this affected you and your whanau? How have you adapted to these changes?
- What changes to the habitats have you observed and how have these affected you?
- What sort of things would you like to see happen in the aquatic environment you associate with and why?
- Are you happy with your current level of access to kai that you value? What are the main barriers you face today?

Wider benefits of gathering kai

- What do you like about being able to go and gather kai?
- When you gather kai are you with other whanau or hapu members?
- What rules or beliefs do you follow with respect to gathering kai?
- Do you feel any special attachment to the places from which you gather your kai?

Health risks

- Do you know of any health risks associated with gathering kai?
- If you were told not to gather kai from an area because of the health risks would you still gather from there?
- What type of information would you need to help you decide whether to gather kai from an unsafe site?

Informal interaction

It must be noted that the formal methods were augmented by many instances of informal discussion, as is the case in most qualitative research.

There were two principal outputs, the first being a map documenting the types, locations, and quantities of kai moana collected and consumed by those present. This was complemented by an analysis of discussions concerning when gathering was undertaken, and the processes used to prepare the kai.

2.5 Qualitative data analysis

In summary, informants were interviewed and interacted with in different forums, and their written documents (both historic and contemporary) and submissions provided further context for interpreting their values, practices, activities and concerns. Accessing multiple sources of data was one of the methodological tools employed to ensure the validity of data collected.

Lincoln and Guba (1985, 224-225) contend that the role of data analysis is "to 'make sense' of the data in ways that will, first, facilitate the continuing unfolding of the research, and second, lead to a maximal understanding of the phenomenon being studied in its context". There were two aspects to the data analysis:

1. firstly to identify sites and resources to be sampled for analysis of contaminant levels; and

2. secondly, the analysis involved identifying, sorting and grouping data from very detailed individual transcripts to identify key themes. The methods of data collection resulted in a considerable quantity of raw data being gathered, and data from a variety of sources had to be systematically analysed.

Data were broken into stand-alone pieces of information, coded and categorised. Categorisation of the data enabled similar themes to be distilled. Some of the themes had been established a priori based on key issues that had emerged while reading related literature and undertaking preliminary discussions when scoping the research topic and negotiating entry to the communities. The question of how to present the data collected from multiple (and mixed) methods was, at times, perplexing. Patterns began to emerge reflecting the diverse nature of the relationship each person had with aquatic habitats, and how and why they believe this relationship has changed over their lifetimes, i.e., how they perceived that these changes have made them feel and behave. Principal categories that were identified represent the headings under which the research findings are presented in sections 5 to 7.

Themes that were distilled from the documentary and interview data were compared with those that emerged from the survey by means of comparative analysis.

It is envisaged that summaries and drafts of this report and the composite report (with the results of the three hapu studies) will be presented and discussed at hui with members of each group.

Before concluding this section it is important to record that the lead researcher for this phase of the research is Ngai Tahu, trained as an environmental manager, employed to advocate in a variety of health and environmental fora for increased recognition of Ngai Tahu beliefs, values and practices, and has worked closely with Arowhenua for a number of years. This must be acknowledged, given the backgrounds from which the participants were selected. There was a possibility that participants gave answers that they thought "she wanted to hear". However by being aware of this possibility, by adopting a disciplined approach to ensure that throughout the data collection and analysis process there was constant referral to the research aims and objectives, and by utilising a range of methods to ensure the research was methodologically sound, the research findings presented in the next section of this report are a fair and accurate interpretation of the data collected.

2.6 Quantitative data analysis

The questionnaire was constructed on Survey Pro 5 (Apian Software Inc) and all data were entered into this programme. The results that are reported in section 5.2 and discussed in section 7 have been produced using the Survey Pro reporting functions. Microsoft Excel was used to construct two of the graphs.

2.7 Summary of methods applied

The methods applied to enable us to understand kai gathering behaviours over different time periods are set out in Table 1.

Table 1: Methods used during the course of the research.

PRE-EUROPEAN SETTLEMENT	19TH CENTURY POST EUROPEAN SETTLEMENT	20TH CENTURY UP TO 1970S – 1980S	PRESENT DAY
Manuscripts	Maori Land Court	Interviews	Interviews
Cultural maps	Land titles for		Review of
Historical texts	Evidence to Royal	Evidence to the	Kai Consumption
Evidence to Royal	Evidence to the Waitangi Tribunal	Photographs	
Evidence to the	Paintings		

3. Study Group

Te Runanga o Arowhenua

The legal identity of Te Runanga o Ngai Tahu is established in the Te Runanga o Ngai Tahu Act 1996. It is the tribal representative body of Ngai Tahu whanui. It is a body corporate, established on 24th April 1996 under section 16 of the Te Runanga o Ngai Tahu Act 1996. Pursuant to section 3 of that Act, "*the Act binds the Crown and every person (including any body politic or corporate) whose rights are affected by any provision of this Act"*.

The members of Te Runanga o Ngai Tahu are the 18 papatipu runanga, each of which is defined in the Act, as is the takiwa for each. Te Runanga o Arowhenua is one such runanga. This establishes who holds manawhenua rights over specific lands and waters within the rohe of Ngai Tahu. Te Runanga o Arowhenua has its offices at the marae at Arowhenua. As one of the 18 papatipu runanga, the takiwa of Te Runanga o Arowhenua, as defined in the Te Runanga o Ngai Tahu Act 1996, centres on Arowhenua and extends from Rakaia to Waitaki, and thence inland to Aoraki and the Main Divide. Figure 2 shows the papatipu marae at which the runanga office is located, while the rohe of Te Runanga o Arowhenua is shown in Figure 3.

Figure 2: The wharenui "Te Hapa o niu Tireni" at the marae at Arowhenua[2].

[2] Photo by Adrienne Rewi http://adriennerewiimagines.blogspot.com/2008_11_01_archive.html

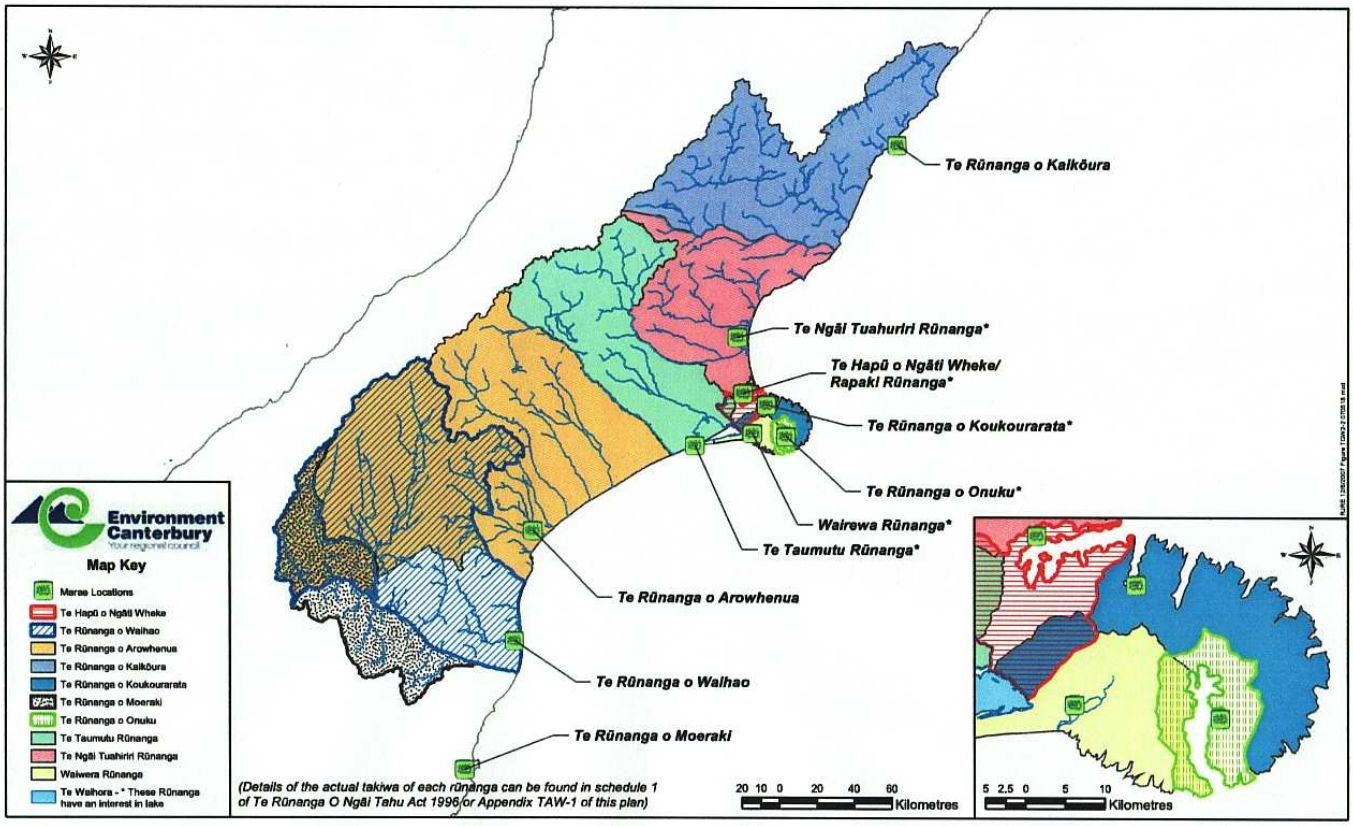


Figure 3: The takiwa of Te Runanga o Arowhenua (Source: Environment Canterbury Natural Resource Regional Plan http://www.ecan.govt.nz/our-responsibilities/regional-plans/nrrp/Pages/read-plan.aspx).

4. International developments relevant to the research

Consistent with the need for the present research to be examined in a context of international literature and academic thought, this section seeks to position the research design and data analyses within contemporary writings from four related areas:

- indigenous communities and participatory approaches to management;
- contemporary wellbeing research, and implications for this study;
- international observations of the impact of changing diets and effects of contaminants on health; and
- Maori conceptualisations of health and wellbeing.

4.1 Indigenous communities and their participation in management

This research sought to utilise participatory research methods. Participation is seen as a means of affording affected parties the opportunity to articulate their interests, enhancing the quality of information available to decision makers; enhancing the potential for support of decisions by enabling early and meaningful involvement; and affecting one's destiny as the opportunity to participate in decisions is a key element of self-empowerment and self-actualisation (Fenge, 1994). In the context of this research project, in addition to collecting environmental contamination data, the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana are examined, and empirical data collected for use by whanau and hapu.

Participatory approaches to environmental management received emphasis initially in the Brundtland report (WCED 1987) and in Agenda 21, at the 1992 ‘Earth Summit’. Perhaps the greatest significance of these fora lay in the acknowledgement that sustainable development would require new approaches to environmental management, and that effective environmental management would need to be differentially negotiated within individual states, even within individual communities. In effect, this research will also result in a range of cultural values and perspectives of particular aquatic locations being documented and available to each Maori community to inform local processes of management should they so choose.

Pimbert and Pretty (1997) contend that new partnerships and connectedness between different interests is required in environmental management and argue that

participatory processes must be locally grounded which will likely require different solutions for different places. This research will facilitate new participatory processes between environmental managers, public health managers, science agencies and Maori. Despite the increase in participatory initiatives, Pimbert and Pretty (1997) also warn that the call for peoples' participation risks becoming a catch-cry and part of the conventional rhetoric without delivering meaningful outcomes for participants. This warning reinforced the desire of the researchers to deliver a meaningful and effective process for application by Maori and outputs such as those listed in Figure 1 for use by Maori and resource managers.

The drive for greater participation has been paralleled by a concerted drive by indigenous communities to reassert their customary and Treaty rights to access and use land and water resources and greater recognition of the knowledge held within communities including indigenous communities (Western et al, 1994, Pinkerton 1989, 1992, Notzke 1994, Berkes and Folke 1998). Although a range of terms are used, often interchangeably, Berkes (1999) defines indigenous knowledge as that knowledge held by indigenous peoples and traditional ecological knowledge as a subset of that – a practical knowledge of species and beliefs regarding human interaction with the ecosystem. Menzies and Butler (2008) list the attributes of traditional ecological knowledge as cumulative (from long term intergenerational interaction), dynamic (informed by a customary lifestyle but not unchanging), providing a historical understanding of change, local, holistic (viewing all elements as interconnected), embedded (in a unique matrix of local, cultural, historical and traditional elements), moral and spiritual. In order to understand the changes to the diets of successive generations of Maori, the research team was dependent on key informants being experienced and knowledgeable (with indigenous knowledge and/or traditional ecological knowledge) about kai gathering.

Sadly, Maori, like other indigenous communities have witnessed the destruction of valued environments and their alienation from the resource bases upon which their cultures and identities are constructed (Berkes 1991, 1994, 1999). Documenting the changes that have been experienced in South Canterbury and the impacts on whanau and hapu, including a profound sense of loss, was therefore vital.

The growth of interest in the knowledge held by indigenous communities is related to the wider shift within resource management to an ecosystem based management approach (Menzies and Butler, 2003) and recognises that indigenous communities understand the way species interrelate and how ecosystems work as a whole. It recognises that indigenous communities have a well developed understanding of the local environment and their own impacts on local ecosystems. The data collected via the interviews and questionnaire confirmed the proposition of Berkes (1999, page 33) that the "use of traditional knowledge may benefit development by providing more

realistic evaluations of local need, environmental constraints and natural resource production systems".

Initiatives involving the incorporation and/or application of indigenous knowledge are emerging around the world as resource managers seek to engage with indigenous communities. New Zealand has also experienced the drive for greater participation, including greater recognition of the beliefs, values and practices of Maori. In 1991, the Resource Management Act 1991 became the governing legislation for resource use in New Zealand (Davis and Threfall 2006). Two sections are of particular relevance.

Section 6 requires that anyone exercising functions and powers under the Resource Management Act 1991 recognise and provide for matters of national importance including "the relationship of Maori and their cultures and traditions with their ancestral lands, water, sites, *wahi tapu* and other *taonga*" (section 6(e)). Gathering from tribal lands and waters, species that are often accorded the status of "taonga", clearly falls within the gambit of section 6(e) and is thus a matter of national importance.

Pursuant to section 7(a) decision-makers are required to have particular regard to *kaitiakitanga*. The Act presently defines kaitiakitanga as:

> *The exercise of guardianship by the tangata whenua of an area in accordance with tikanga Maori in relation to natural and physical resources; and includes the ethic of stewardship based on the nature of the resource itself.*

The responsibilities of Tangata Kaitiaki are to protect the integrity of resources (including the kai species identified by informants). This requires Maori to focus on long term environmental results, which are likely to include healthy ecosystems with abundant populations of valued kai species that are able to sustain cultural uses well into the future. Despite these encouraging and potentially enabling provisions, often there is little guidance given to managers and regional bodies seeking to meet the obligations to indigenous communities (a challenge Maori confront in New Zealand). This research seeks to produce outputs that will guide both Maori and non-Maori resource managers.

4.2 Contemporary wellbeing research: implications for this study

For indigenous communities food is not just a resource for sustenance as many might understand it in western contexts (Slocum 2007). Rather, Panelli and Tipa (2007, 2008) argue, that food needs to be understood in a wider cultural context that interweaves complex indigenous cultural and environmental relations.

Panelli and Tipa (2007, 2008) contend that to identify these relationships primarily by a particular bio-physical character (e.g., forests, coasts and waterways) misses the range of spiritual, physical, social, material, cultural, economic and political relationships that might be involved in any one case. The complexity of these relationships must be appreciated before the significance of an 'individual' phenomenon or activity (such as food or food gathering) might even begin to be approached (let alone the cultural or health implications of such things). They further contend that to consider kai gathering without this contextual understanding would diminish its cultural value and the rich dimensions that underpin whanau and hapu experiences of identity and well-being. The results of the Kai Consumption Survey reported in subsequent sections of this report support the proposition that individual experiences of interviewees vary as lives are influenced by a complex combination of: cultural beliefs, values and uses; a history of colonization, loss of lands, alienation from their lands, waters and resources; and contemporary interactions with a dominant non-Maori world that is based primarily on capitalist, western values (Panelli and Tipa, 2008). The range of perceptions, preferences and the experiences of members of Te Runanga o Arowhenua that emerged from the analysis of data collected for the present research are set out in sections 5 – 7 of this report.

Indigenous communities have traditionally been resource users and developers (O'Regan 1984, Notzke 1994). They used natural and physical resources for subsistence (physical survival) and sustenance (spiritual survival). Internationally there are calls to recognize and protect cultural knowledge and practices that are 'fundamental for food security and well being' (FAO 2007). Gombay (2005: 418) explains the significance of this stance, and when describing the Inuit argues that when they:

> *hunt, fish, or gather food the material and immaterial worlds blend together, with layer upon layer of meaning and understanding. The getting of country foods is about understanding the land in which one lives. It is about building an awareness and knowledge of one's place in the natural world ….*

The gathering, exchange and consumption of kai are also significant cultural activities for Maori. Complex associations with the environment and mahinga kai have developed over centuries and include social, economic, psychological, spiritual and physical dimensions that are an intrinsic part of health and well-being of whanau members. Diversity is wide (as evidenced by the individual variation from the survey results) but this is considered acceptable within whanau and hapu. The data collected helps explain how sourcing kai from lands and waters reaffirms firstly, connectedness with the lands and waters to which one has whakapapa, and secondly ensures continuity of practices initiated and valued by tupuna. In the Ngai Tahu context, mahinga kai practices also enable social and environmental responsibilities to be

fulfilled. To be denied the opportunity to manaaki visitors to one's home and marae would have consequential adverse effects on the health and well-being of Maori – a point that may be experienced beyond the individual and whanau level.

4.3 Maori conceptualisations of health and wellbeing

Durie (1994) introduced *Te Whare Tapa Whā* - a four sided house - or the four cornerstones of health; these being: *hinengaro* (mental well-being), *wairua* (spiritual well-being), *whanau* (family well-being) and *tinana* (physical well-being) which was subsequently adopted by the Ministry of Health (2006). Durie (2004) then proposed a second conceptualisation, *Te Pae Mahutonga*, which he contends represents the fundamental components of health promotion - *Mauriora, Waiora, Toiora* and *Te Oranga*. He explains that: *Mauriora* is dependent on a secure cultural identity; *Waiora* refers to healthy air, land and water environments which requires a balance between use and development and protection; *Toiora* focuses on personal behaviours and responsiblities; and *Te Oranga* recognises that health promotion (in particular increasing well-being) requires increased participation by Maori in societal affairs.

Another conceptualsation, by Pere (1997) emphasises reciprocity and interconnection between individual selves and wider social interests. In this sense, each experience of well-being would vary from place to place reflecting *whenua* (earth), *turangawaewae* (standplace), *whanaungatanga* (kinship), *whanau* (family), *wairua* (spirit), *hinengaro* (mind, heart), *whatumanawa* (feelings) and *tinana* (body). This conceptualisation by Pere helps explain connections between specific understandings of *whenua* and the social and cultural relations developed in particular places.

Panelli and Tipa (2008) explain how many Maori express a strong affinity for the earth and adhere to basic principles regarding their relationship with other aspects of creation and quote Crengle (2002) who explains all parts of the environment are related to one another and exist within a mutually inter-dependent whole. Deriving economic or social benefit from resource utilisation (recognised as contributors to wellbeing), must be carefully balanced.

Initiation of the current research programme and exploring the contribution of kai gathering to health and wellbeing is predicated on the belief that understandings of health and well-being can be enhanced by explicit conceptualisations that align spiritual, social and cultural elements in connection with bio- physical bases.

4.4 Effects of contaminants on health

While some agencies and researchers contend that people everywhere are exposed to chemical contaminants in the environment, international studies confirm that the majority of exposure to contaminants comes from food, with the consumption of contaminated fish identified as the largest single source of exposure in Canada (Health Canada 1997). Of concern, fish constitutes a significant dietary source of protein for many populations worldwide, especially indigenous communities.

Traditionally, the diet of many indigenous communities (including Maori) consisted of fish, game, waterfowl, and plants sourced from local lands, waters and coasts. Contemporary diets, in contrast, are likely to be a combination of traditional food items and more easily accessed commodity or convenience foods. Despite the change to convenience foods, traditional foods continue to underpin cultural identity for many indigenous communities. Delormier and Kuhnlein (1999) explain how changes experienced by Eastern James Bay Cree have affected diet, traditional food use, and nutrition. They contend that the reduced use of traditional food by younger generations, changes in fish consumption as a result of contamination, and increased incidence of obesity, diabetes, and cardiovascular disease within communities, represent particular socio-cultural concerns. Exploration of these issues and the longer term impacts has necessitated examination of the current diet and food consumption patterns of the Cree. The nature and extent of the risk that Maori confront in New Zealand is unknown but this research attempts to assess the risk.

If food is a major route of human exposure to many persistent toxic environmental contaminants the present research hypothesised that the consumption rates of aquatic species by Maori could represent a significant risk of exposure given their potential higher rates of consumption of these foods. The information gathered through the interviews and the questionnaire therefore had to enable the research team to establish whether there were any correlations between the contaminant levels measured in the participants' tissues (hair) (a separate component) and the fish or shellfish species they consumed in the past year. While such a relationship could not be considered as defining a direct cause:effect relationship, it would increase our understanding of the possible exposure risk to tangata whenua. We have also developed a model of potential contaminant accumulation pathways between participants and the kai they consume and calculation of relative risk, based on measured contaminant levels in kai species, their associated environments and consumers. Furthermore, the data had to enable the research team to assess the levels of contaminants in the respective fish and shellfish species consumed, by identifying important species and harvesting locations. These data were subsequently used to develop a sampling plan for kai species and associated environmental parameters. The results of these strands of research are to be presented elsewhere.

In risk management, the focus is on ensuring that mitigation strategies are culturally appropriate yet rarely are Maori perspectives or knowledge explicitly included in determining the hazards or health outcomes to be considered in the risk assessment. In the absence of explicit procedures to apply health risk assessment in Maori communities, the data derived from the questionnaires and interviews will contribute to the development of a health risk assessment model. Again using data gathered from this stage, we will develop Maori-focused guidelines with respect to the consumption of wild sourced kai and will also explore the appropriateness of existing information dissemination tools for effectively communicating risk.

5. Research results

In this section of the report we start by providing a description of the mahinga kai practices of whanau and hapu across South Canterbury prior to European settlement before profiling the present day behaviours of whanau members and highlighting changes from traditional lifestyles. Although challenging, we also seek to identify causes for the changes. The information relating to traditional practices is extracted from secondary data sources (including tribal manuscripts). Interviews with whanau members and the Kai Consumption Survey provided the data from which the contemporary profile was constructed.

5.1 Traditional patterns of gathering

From the oral histories of Ngai Tahu and written manuscripts, descriptions of a stable mahinga kai based lifestyle emerges. Evison (1993) describes how the great number of plants, birds, and fish that comprised the food sources of Ngai Tahu assured always that somewhere, something was available to eat. An outstanding characteristic was the sequential utilisation of a variety of natural resources from widely dispersed localities mirroring the cycles of rivers and species (Dacker 1990, Anderson 1988, 1998). This pattern of resource use shaped an itinerant lifestyle where mobility was pronounced and essential.

Movement and an understanding of the resources available over a wide territory were therefore crucial for sustaining the livelihoods of Ngai Tahu whanui prior to European settlement (WT[3], 1991, J10:99). Anderson (1998) described how the population dispersed during late spring to autumn to inland regions and retreated to long term settlements (typically nearer the coast) in winter and early spring.

Various resources which were seasonably abundant would be preserved and the food taken back to these more permanent settlements (WT, 1991 - H1:76–77). Other purposeful travels included inland hikoi to collect pounamu and the annual migration south to the Titi Islands in autumn to obtain titi (mutton birds). Mahinga kai was the basis of the Ngai Tahu economy and culture before contact with Europeans.

European settlement inevitably impacted Ngai Tahu mahinga kai resources and patterns of activity. Evidence given by Ngai Tahu whanui to Commissioner Mackay in 1891, who convened one of the Royal Commissions, stressed the loss of mahinga kai and the consequent adverse impacts on the lifestyles of whanau and hapu. While

[3] "WT" is used as an abbreviation of the Waitangi Tribunal.

fishing and eeling were still available to whanau and hapu, eventually these sources of food were also at risk (WT 1991, F11:51).

In this chapter we distinguish kai gathering in four time periods:

- pre European settlement;
- post European settlement – in mid to late nineteenth century;
- twentieth century up until the 1970s and 1980s; and
- the present (results of the present study).

5.1.1 Pre-European settlement - Traditional settlements and patterns of resource use

Ngai Tahu place names provide insight into the use of lands and waters, and the resources sourced from them. Individual Ngai Tahu within their living memory would have a mental map of important places that supported their itinerant lifestyle, including camping places, settlements, and the different resources that could be obtained and utilised - all held in memory like whakapapa, where the sequence and significance of every place was known (Kruptnik, 2002). The writings of ethnographers, such as Beattie, yield hundreds of place names[4]. Sadly, over time the location of many has been lost.

Figure 4 illustrates some of many place names found across South Canterbury and confirms widespread use of the region by Ngai Tahu. Each of the sites in Figure 4 represents a valued mahinga kai site that was instrumental in providing the resources essential to sustaining whanau and hapu. A summary of the mahinga kai sourced from these sites are shown in Figure 5 with a more detailed list of the 38 species obtained from these sites across South Canterbury presented in Table 2.

[4] Beattie recorded over 1400 place names for Canterbury. Other ethnographers obtained more.

Table 2: Species were traditionally gathered from across South Canterbury.

SPECIES				
Eels	Smelt	Flounder	Potato	Turnip
Rats	Seals	Whitebait	Whale	Aruhe
Sea nuts	Kanakana	Patete	Kauru	Flax honey
Flax	Panako	Kumara	Shark	Groper
Shellfish	Paua	Sea urchins	Tutu	Kokopu
Koareare	Weka	Kahawai	Cabbage	Kokopara
Kanaka	Pakihi	Minnows	Taramea	Birds
Mullet	Puha	Watercress		

The 1880 map and accompanying manuscript, commonly referred to as the "Taiaroa papers" by Ngai Tahu, represent a highly valued "cultural map". It was an initiative by kaumatua from neighbouring hapu and facilitated by H.K. Taiaroa, to map their collective territory, their mahinga kai interests and values associated with particular sites[5]. These records allow a more complete examination of the system of food gathering system within the Canterbury and Otago regions.

[5] Nearly 1400 places across Canterbury and Otago were written down and mapped which coincided with the Smith Nairn Commission enquiry (1881).

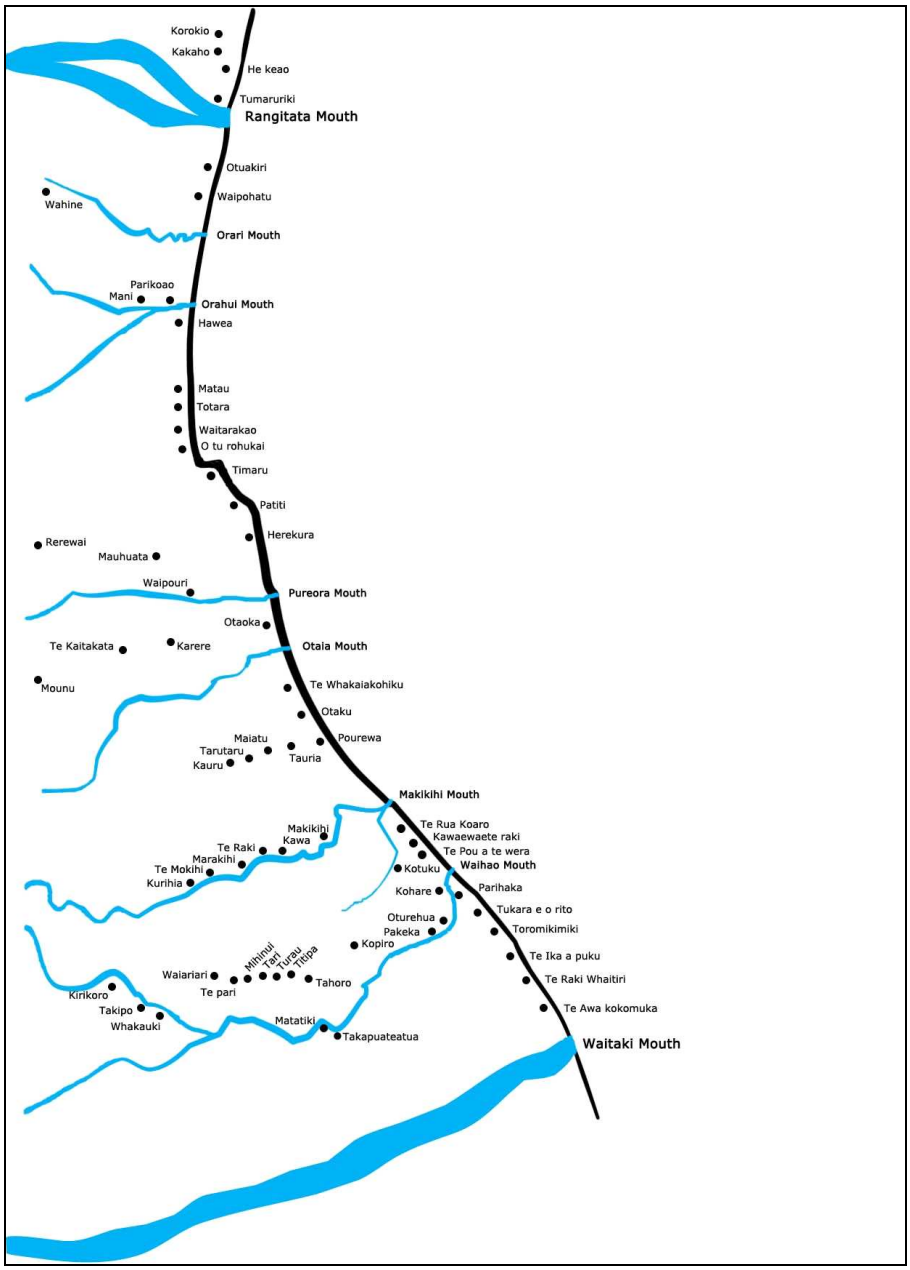


Figure 4: Traditional place names across South Canterbury.

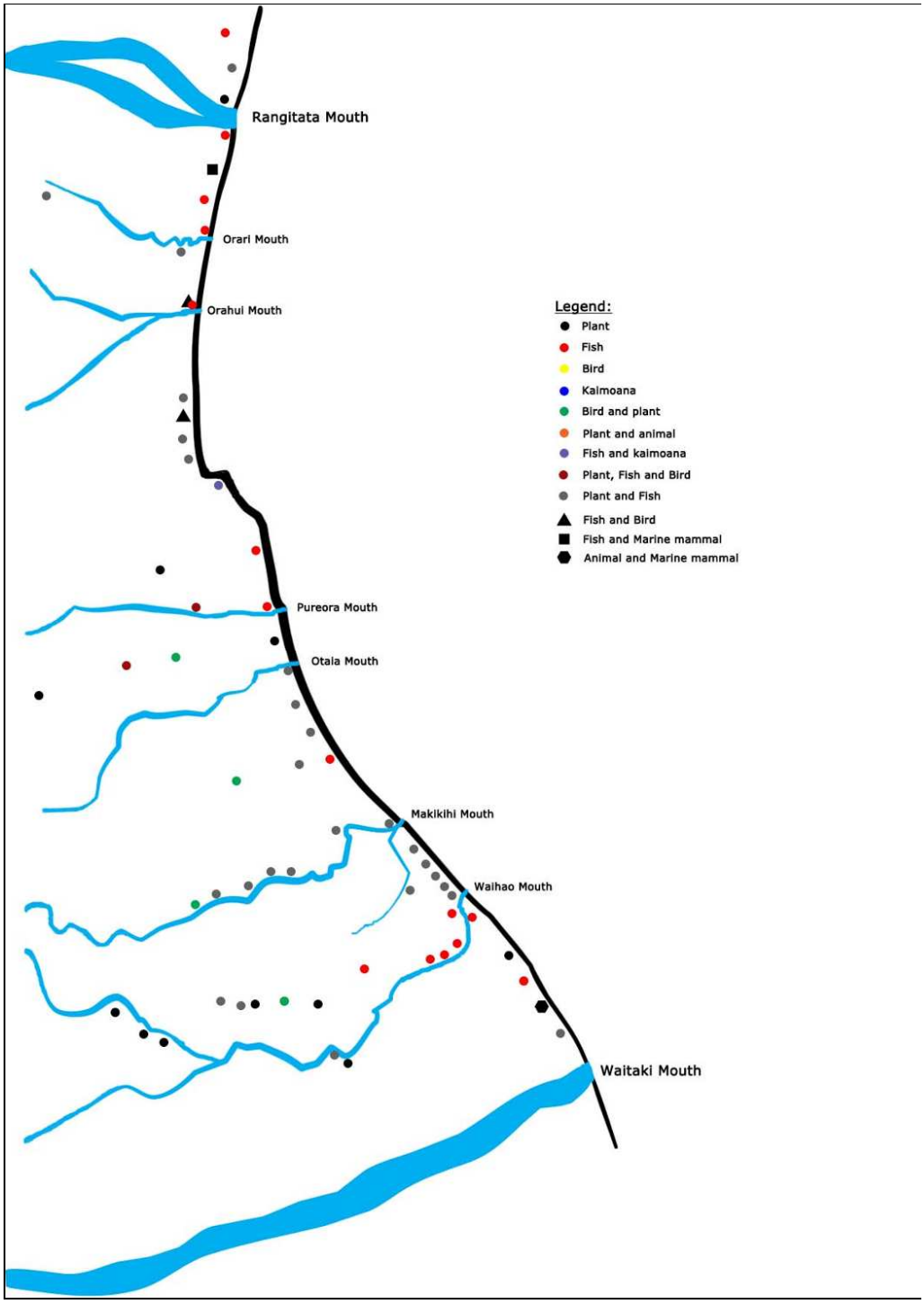


Figure 5: A few of the mahinga kai sites found across South Canterbury. (Please note that there were considerably more sites than those shown above. To avoid congestion of the map and to preserve the location of some sites, the names and uses of sites have been withheld).

As Table 2 shows, thirty eight different foods and materials were gathered from more than 100 sites across South Canterbury (between the Waitaki and the Rakaia and extending inland to the main divide). Table 3 shows the ten most commonly gathered species.

Table 3: Percentage of sites from which species were gathered from across South Canterbury.

SPECIES	PERCENTAGE OF
Eels	72%
Kauru (extract from the cabbage tree)	24%
Minnows	19%
Aruhe (bracken fern)	19%
Turnip / potato	13%
Whitebait	11%
Flax	11%
Koareare (root of the bulrush)	9%
Weka	8%
Kokopu / kokopara	8%

A distinctive social order emerged in the south shaped by the colder climate that dictated an itinerant lifestyle. Each whanau and hapu had rights to particular river reaches for fishing and defined lands for gathering wildlife and plants (Williams 2004, Anderson 1998). These areas were known as *rauiri* (preserves) and defined by *wakawaka* (boundaries) (Beattie 1939, Best 1942). It must be acknowledged however that traditionally rights had to be maintained through continual usage. Through an annual cycle of fishing, gathering and hunting, whanau and hapu "kept the fires burning" in many locations across a large tract of the South Island. Intermarriage between hapu and subsequent rights of inheritance and succession mean that for many Ngai Tahu today they now hold rights to lands across much of the southern region.

Historically enough kai was gathered to feed the immediate and extended whanau with some remaining to donate or trade. Mahinga kai meant survival. Sharing with those unable to gather for themselves is a practical expression of *whanaungatanga*. Concepts of *tapu* and *noa* shaped a management system that limited the scale of gathering (Anderson 1998, Williams 2004), but mistakes would have undoubtedly led to waste, overexploitation, and the collapse of some food sources. Knowledge of such mistakes passed from generation to generation in the form of *tikanga* and *kawa* (correct protocols and practices) the function of which was to prevent a repeat (Williams 2004).

Mahinga kai was the basis of an economy based "principally on the giving of gifts upon which were attached the obligations of reciprocity" (Williams 2004,p 88). By the time of European settlement Ngai Tahu had built a robust economy and a rich culture adapted to the local climate, resource base, and landscape (Evison 1993). Gathering was a social activity as well as an economic one. The extensive network of rivers, lakes, mountain ridges and valleys provided avenues of travel essential to Ngai Tahu social and economic relations. South Canterbury, in the middle of Te Wai Pounamu, provided links to the inland areas of the Mackenzie Valley, to the Upper Clutha and to Te Tai Poutini. Hapu and inter-hapu ties and alliances, the backbone of Ngai Tahu social and economic exchange systems, depended upon the free and easy movement of people within and beyond South Canterbury.

5.1.2 Post-European Settlement: Reserves and fishing easements awarded in 1848 and 1868

> *"Even after the land purchases, Ngai Tahu continued to gather their traditional food, not only from areas near their settlements but also in journeys to far places. Despite the development of pastoral farming by the new settlers many Ngai Tahu continued to rely on their traditional hunting grounds for their existence".* (Waitangi Tribunal 1991)

With promises of government payments for the purchase of lands, the retention of fishing and hunting rights, and allocation of a series of reserves, Ngai Tahu were persuaded to surrender title to significant tracts of land and the pattern of rauiri and wakawaka was disrupted. According to the Government's policy of setting aside reserves, small tracts of land were identified as reserves to protect Ngai Tahu from settlers. In practical terms however reserves enabled all lands beyond the boundaries of reserves to be opened for settlement.

Many of the reserves and fishing easements (listed in Tables 4 and 5 that were granted to enable the continuation of a food gathering lifestyle) can be traced back to Crown Grants to Ngai Tahu whanui which stem from the Southern Purchase Deeds negotiated between 1844 and 1857. As an unanticipated consequence of the sale and transition to newly acquired reserves, Ngai Tahu were no longer free to migrate seasonally across the plains of Canterbury.

As the lands along lowland catchments of South Canterbury were taken over by settlers, fences curtailed gathering of kai from many valued sites. Although Ngai Tahu were determined to maintain their relationship with mahinga kai, this period of land alienation and substitution with reserves and easements marked the initial transition from a traditional diet and a lifestyle dictated by resource utilisation.

Table 4: A list of some of the native reserves in the province of Canterbury (Mackay, undated).

Reserve Name	Acres	Interest
Section 12,373 Waikawa	150	
Kaikanui	4	Reserved in 1848 by Mantell in terms of Kemps Purchase
Arowhenua	376	Reserved in 1848 by Mantell in terms of Kemps Purchase
Waipopo	187	Reserved in 1848 by Mantell in terms of Kemps Purchase
Te Upoko o Rakaitaweka	20	Reserved in 1848 by Mantell in terms of Kemps Purchase
Tauhinu	23	Reserved in 1848 by Mantell in terms of Kemps Purchase
Waimatemate	40	Reserved by the Canterbury Association
Waikawa	138	Selected in lieu of reserve at Hakataramea
Rakipaua	20	Reserved in 1848 by Mantell in terms of Kemps Purchase
Arowhenua	2	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Arowhenua	150	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Arowhenua	30	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Arowhenua	20	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Waimatemate	500	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Waimatemate	30	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Waimatemate	10	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Waimatemate	20	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Taumutu	63	Reserved by the Governor General to supplement land at Taumutu
Kapunatiki	600	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Orari River (north)	10	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Orari River (south)	20	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Waitangi	10	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848

Because this research focuses on aquatic ecosystems, Table 5 extracts from Table 4 the reserves relating to the Fenton Orders of 1868 and highlights their relationship to

aquatic ecosystems. These reserves and easements are important as even today they continue to sustain the gathering of freshwater aquatic species. However access to and the ability to gather many of the terrestrial species listed in Table 1 was denied from the mid nineteenth century.

Table 5: A Summary of Fenton Orders of 1868 resulting from Kemps Deed of 1848[6].

Location	Association with water
450 acres Waitangi District (Waihao Maori Reserve)	
30 acres District (Glenavy sections)	
10 acres Waitangi District – near Wainono (Te Houiri Maori reserve)	Fishing easement - Near Wainono Lagoon. Bounded on the westward by a small lagoon.
20 acres Waitangi District (Puhakati Maori Reserve)	Fishing easement
10 acres Waitangi District Awakokomuka Maori Reserve	Fishing easement (now inaccessible)
600 acres Timaru District – Kapunatiki	The southern boundary skirting the edge of the swamp
10 acres Timaru District – south bank Orari River	Fishing easement - Having 10 chains frontage to the south bank of the river
20 acres Timaru District – north bank Orari River	Fishing easement - Having 10 chains frontage to the north bank of the river (has now disappeared)
2 acres	Fishing easement - A square block of land from the stream from Waitarakao Lagoon (near Washdyke)
150 acres Timaru District – Kapunatiki Creek	Is now gone – disappeared.
72 acres	Part of island near Harereatou Lagoon in the mouth of the Umukaha River – this is now washed away.
20 acres Timaru District – Orakipaoa (to include old pa)	

Figure 6 illustrates the location of the fishing easements in Canterbury, including the five in the Arowhenua district which are highlighted.

[6] This information was sourced from Taylor (1950) and from descriptions found in a report titled *Research into Maori Fishing Reserves: Establishment of Rights – Objections and Complaints from 1840"*. The senior author was given a copy of the report by Kelly Davis.

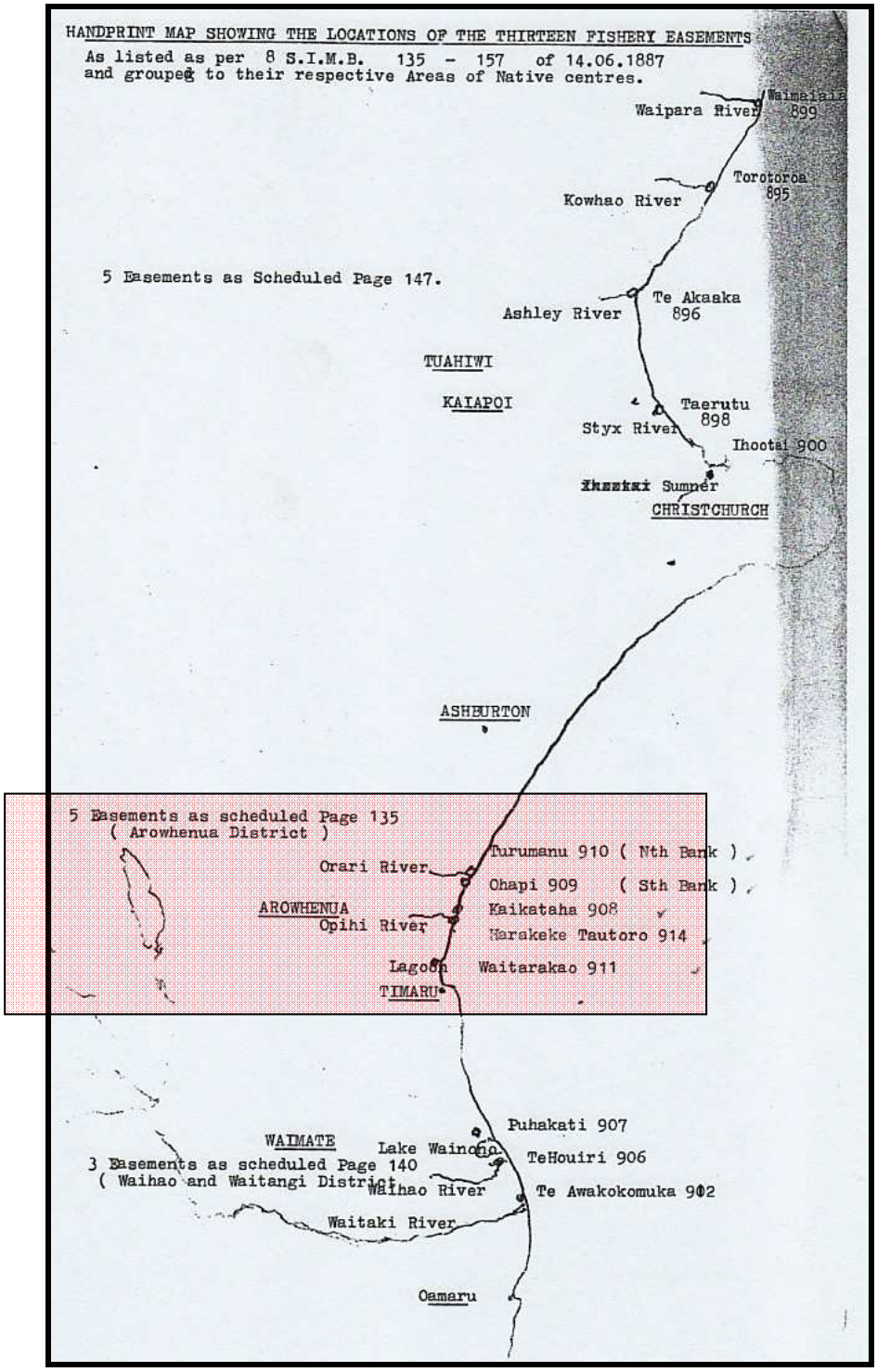


Figure 6: Location of fishing easements in Canterbury.

Figure 7: Coastline near Timaru – September 1874 (Australian National Library).

Figure 8: Washdyke Lagoon – near Timaru, October 1874. Thirty acres of this has now gone (Australian National Library).

Figure 9: Washdyke Lagoon 1874 (Australian National Library).

5.1.3 Comments presented in support of the Ngai Tahu Claim to the Waitangi Tribunal in 1989 – 1990.

Members of Te Runanga o Arowhenua presented evidence to the Waitangi Tribunal in 1989-90 in support of the Ngai Tahu Claim (Wai 27). They explained how all the lakes and rivers in the South Canterbury area that were once a source of food had been modified and adversely impacted since European settlement. These statements to the Tribunal provide insights into the changing mahinga kai practices experienced by whanau living across South Canterbury, and importantly with respect to this research, identify emerging contamination concerns.

Kai gathering

- Mr Jack Reihana recalled camping for a week or more to catch and preserve eels at Lake Wainono and spoke of an old lady bringing home large quantities of dried eels from Waitarokaoa (Washdyke) (WT 1991, H10:2).

- Mr William Torepe reviewed past and [then] present availability of mahinga kai from Waitaki to Rakaia (H10:4) which included kai such as tuna, fish, watercress, wild fowl and acclimatised species in the Opihi, Waihi and Temuka Rivers, Milford Lagoon, Hae Hae Te Moana, Kakahu, the beach in the vicinity of Pareora River, and Waimate Creek. He then proceeded to comment on the "diminution of Maori kai" and how this has affected their ability to manaaki guests on the marae (WT 1991, H10:8).

- Mr Kelvin Anglem spoke of the past abundance of eels in the Opihi which were preserved or bartered. He also commented on the [then] depletion of tuna, whitebait and kanakana (WT 1991, H10:19). He lamented the shortage of eels in the Opihi River which once supplied in one night their whole winter's supply.

- Mr Kelvyn Davis-Te Maire stressed that the areas were not merely important for mahinga kai but were also areas of historical importance (WT 1991, H10:33–34).

- Te Ao Hurae Waaka, related the past history of the district and how the whole area from the eastern seashore to the main divide had been accessed by Arowhenua (WT 1991, H10:47; H47.1).

The impacts associated with introducing exotic species

Although Ngai Tahu had repeatedly voiced their concerns at the impact of introduced aquatic species, the general consensus of those presenting scientific evidence to the Tribunal was that the decline in native species was due to changing land use rather than from competition with exotic fish. Mr Davis-Te Maire was critical of the management of water fowl by the Acclimatisation Society (now restructured as the Fish and Game Council) (WT 1991, H10:33). Mr Anglem described eel drives designed to protect young trout, when hundreds of eels were slashed and killed with lengths of hoop iron and allowed to flood down the river or left to rot on the banks (WT 1991, H10:23).

Water extraction

Mr Torepe spoke of the lack of water in the Opihi River - an important mahinga kai location (WT 1991, H10:2). He attributed this to the issuance of permits by the Regional Water Board to allow the Timaru City Council to draw off water for domestic supply and permits for farmers to take water for irrigation. He observed that this had the effect of reducing flows in the lower Opihi River, leaving it dry for at least three months of the summer with the consequent effect on kai resources. He claimed that the majority of streams and creeks within Canterbury had been transformed into flood channels. He believed the supply of fish in the Opihi River was now depleted as a result of water reduction.

The Opihi River has been affected by flow reductions since about 1936, when the Levels Plain Irrigation Scheme began operation. These reductions created a number of problems for fish stocks.

- Compounding the impact of low flows, another witness, Mr Sagar, contended that changes in land use within the catchment, and flood protection works had all contributed to modifying the river system.

- Mr Little stated that not only does water extraction lead to a loss of fisheries habitat, migration routes and cover, it also results in changes in temperature, increased weed growth and possibly destruction of the river (WT 1991, P15a:10).

It was thought that modest increases in the flow of the Opihi would improve the fisheries values of the river. A minimum was instituted following commissioning of the Opuha Irrigation Scheme. Although dewatering is not longer a problem, a number of issues persist.

The demands for water from so many uses, coupled with river re-alignment, plus land loss when floods washed away acres of reserve land, and the drainage of creeks and swamps, all served to adversely affect Ngai Tahu's access to mahinga kai. It also contributed to another serious consequence – the problem of pollution.

Pollution

Mr Anglem identified factors such as sewerage disposal, wool scour effluent, dairy factory discharge, aerial spraying and topdressing, farm waste and irrigation diversion which had reduced the Opihi and its estuary from an important breeding and feeding ground for migratory birds and fish into something unfit for humans and animals to swim in, concluding:

> *I am glad my Tupuna cannot stand on the banks of the Opihi and see what I have stood back and allowed to happen to their river.* (WT 1991, H10:24)

Mr Torepe (17.2.5) said that dirty and greasy effluent was discharged into the Waihi River at Winchester (WT 1991, H10:2). He also added that the beach in the vicinity of the Pareora River may be polluted by freezing works discharge of untreated remains (see Figure 10 below).

Figure 10: Opened in 1904, the Pareora Freezing Works is one of two meat-processing plants in the region – Smithfield at Washdyke is the other. The red hue in the sea is effluent from the works. (Photo source: www.teara.govt.nz/files/p11486gns.jpg).

A report from the water resources manager of the South Canterbury Regional Water Board (WT 1991, H49) dated 8 April 1988, describes the water quality in the Waihou River, Lake Wainono, Opihi River, Temuka River, Orari River, Rangitata River and the coastal zone. The problem of eutrophication within the Waihi–Temuka River system and the lower Orari River was highlighted. The report explained that eutrophication results mainly from the introduction of nitrogen and phosphorus. Fertiliser on farmland was seen as the major source of nitrogen. Domestic sewerage was believed to be the major source of phosphorous which it was thought could be addressed by upgrading the oxidation ponds at the Geraldine and Temuka treatment plants.

The witnesses to the Waitangi Tribunal concluded that there were serious water quality problems in the Temuka River and indeed they predicted problems in other rivers in the future. The members of the Waitangi Tribunal concluded after viewing the lower Opihi River that diverse sources of nutrients from adjacent farmland and the shortage of water in the river generally have changed the structure of the river with a serious effect on the mahinga kai qualities.

Without doubt, social and economic shifts during the last 160 years resulted in major changes in the relationship between Ngai Tahu and mahinga kai. The cumulative effect of settlement, an industrial economy that saw newly arrived settlers exploit all economic resources, plus the plethora of regulatory systems instituted by government, changed both the circumstances and practice of mahinga kai, with both natural environments and resources impacted, and consequently the knowledge generating processes associated with kai gathering being changed or alienated from many Ngai Tahu.

5.2 Contemporary patterns of gathering

This section draws on the data from the Kai Consumption Survey to describe contemporary kai gathering practices and behaviours. Where appropriate quotations extracted from the interviews with whanau members are added.

5.2.1 Background of participants

All participants were Maori residing in the South Canterbury region.

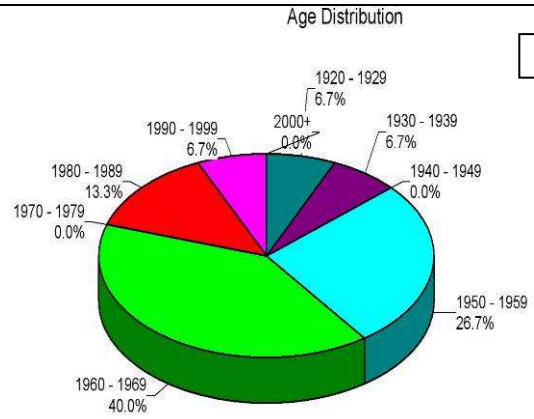


Figure 11

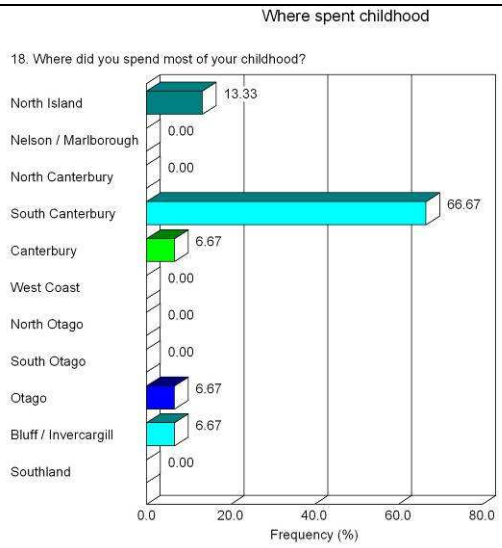


Figure 12

Only a limited number of participants have completed the survey (Figure 11):

- 1 is aged 10-19 years
- 2 are aged 20-29 years
- 6 are aged 40-49 years
- 4 are aged 50-59 years
- 1 was aged 70-79 years
- 1 was aged 80-89 years

Of the 15 participants 2 were female and 13 were male.

Two thirds of the participants spent their childhood in South Canterbury (within the takiwa of Te Runanga o Arowhenua) while two of the participants grew up in the North Island (Figure 12).

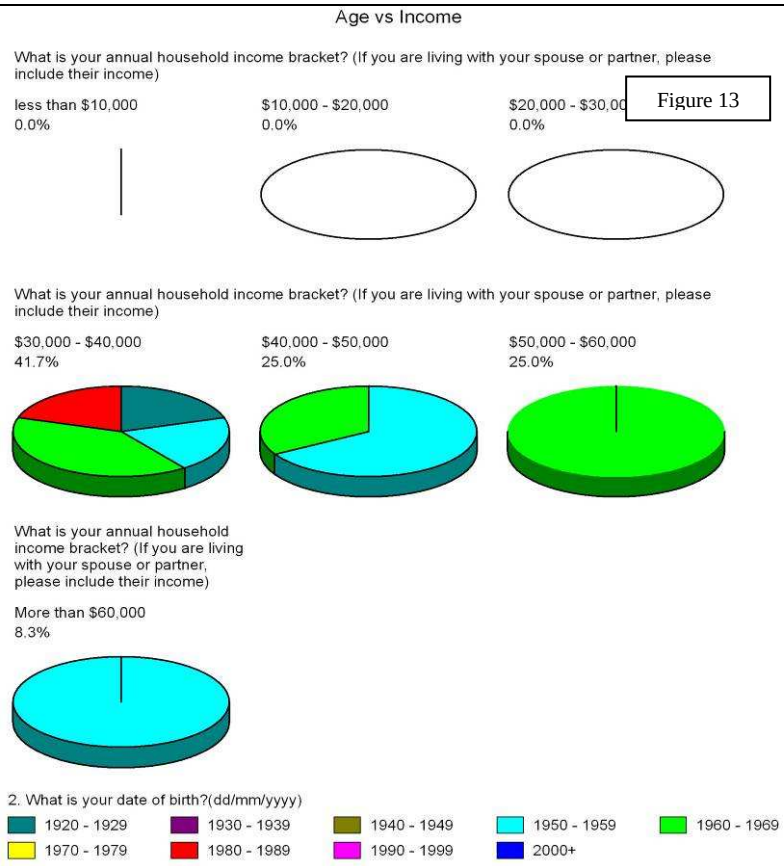


Figure 13

With respect to income (Figure 13)

- 41.7% received between $30,000-$40,000 – which was the lowest recorded.
- 25% earned between $40,000-$50,000.
- 25% earned between $50,000-$60,000.

The data relating to income, as shown in Figure 13, can be compared to data collected from the 2006 census when:

- 44 percent of Ngai Tahu reported an annual personal income of $20,000 or less, while 6 percent received over $70,000.
- The median annual income (half receive more, and half receive less, than this amount) for Ngai Tahu was $23,400 in 2006. In comparison, the median annual income was $21,900 for the total population of Maori descent, and $24,400 for the total New Zealand population.
- The median annual income was $30,200 for Ngai Tahu men and $19,200 for women.

5.2.2 Patterns of kai consumption

The principal purpose of the Kai Consumption Survey was to determine the extent of gathering by whanau living in South Canterbury. The range of species that are consumed are listed in Table 6.

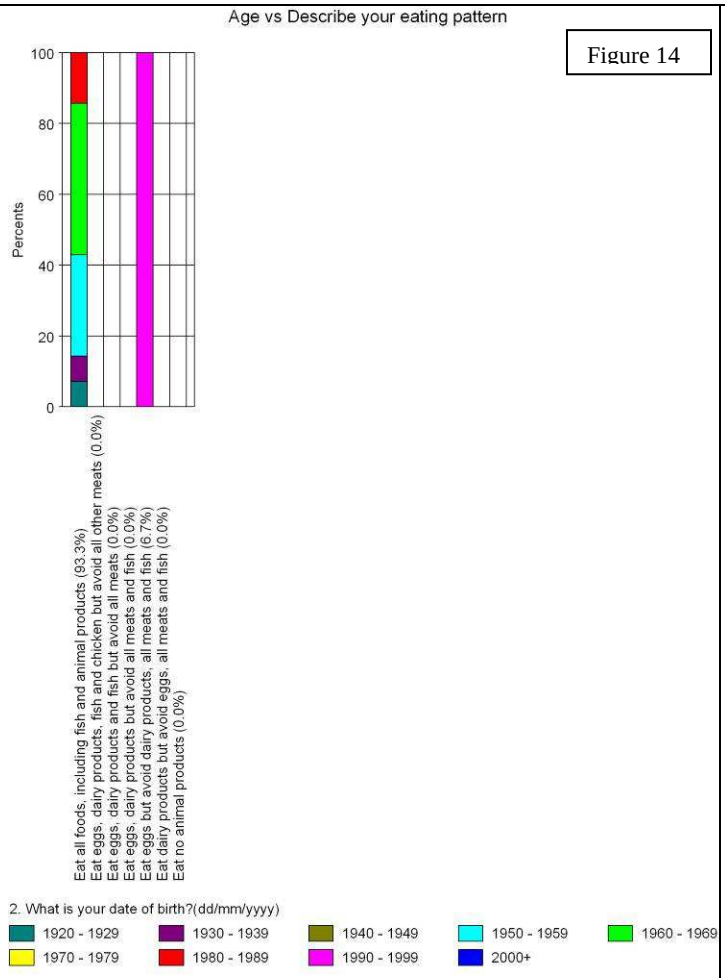
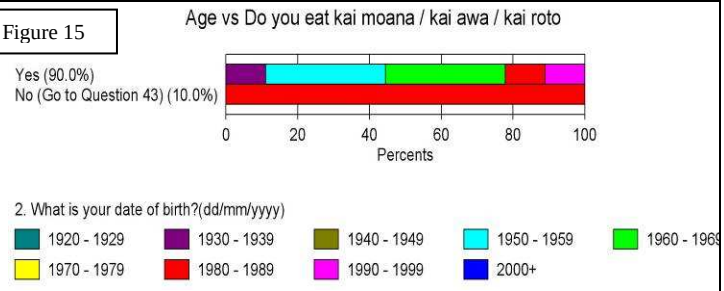


Figure 14

The majority of participants (93%) eat all foods, including fish, meat and all dairy products (Figure 14).

The exception was the tamariki who avoids dairy products, meats and fish.

Figure 15



90% of participants across all age groups eat kai moana, kai awa or kai roto (Figure 15). Only 10% (all aged between 20-29 years) do not eat kai moana, kai awa and kai roto.

Table 6: A comparison of foods historically sourced from sites in South Canterbury compared to foods gathered and consumed today.

KAI (**GATHERED** HISTORICALLY)	KAI (**GATHERED** TODAY)	KAI (**CONSUMED** TODAY)
		Butterfish
		Freshwater mussels
		Morihana
	Herrings	Herrings
		Pipi
		Cockles
		Toheroa
		Tuatua
		Greenbone
Kanakana	Lampreys	Lampreys
		Mutton birds
Eels	Eel	Eel
Flounder, Pakihi	Flounder	Flounder
Groper		Hapuka
Mullet	Mullet	Mullet
Kahawai	Kahawai	Kahawai
		Kingfish
		Gurnard
		Snapper
		Moki
Shark	Shark	Shark
		Tarakihi
		Trevally
Whitebait, Smelt, Minnows, Kokopara, Kokopu, Patete	Whitebait	Whitebait
	Trout	Trout
Sea urchins	Kina	Kina
Paua	Paua	Paua
	Mussels	Mussels
	Crayfish	Crayfish
	Oysters	Oysters
		Pupu
	Seaweed	Seaweed
		Freshwater crayfish
Watercress	Watercress	Watercress
Puha	Puha	Puha
Potato, turnip, cabbage		
Flax, flax honey		
Seals		
Aruhe		
Rats		
Koareare		
Sea nuts		
Whale		
Kauru		
Kumara		
Tutu		
Panako		
Weka		
Birds		
Taramea		
Shellfish		

Only 11 of the list of species gathered historically (as listed in Table 3) are still gathered and consumed today. These are highlighted in Table 6.

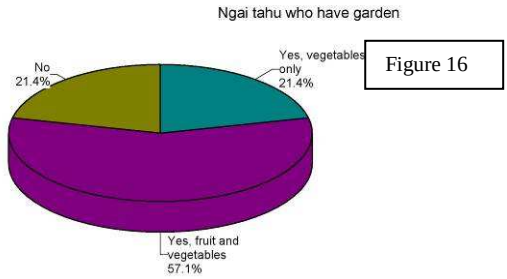


Figure 16

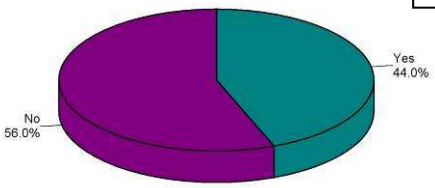
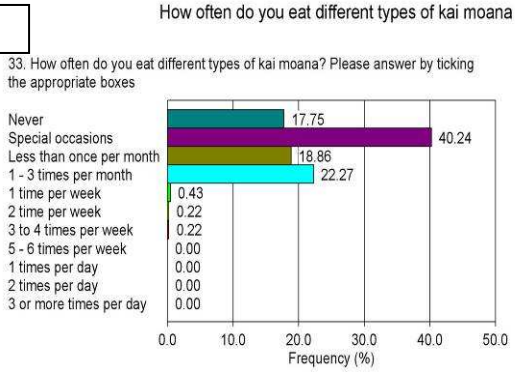


Figure 17

Figure 18



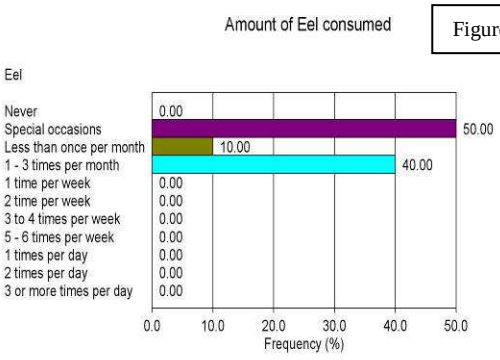


Figure 19

Consistent with the itinerant kai gathering lifestyle of their tupuna.

- 44% of respondents hunted, while
- 78.5% grew their own vegetables.
- Of the 78.5%, 57% of those who grew vegetables also grew fruit (Figures 16 and 17).
- The data also showed how after the introduction of potatoes and turnips by settlers, Ngai Tahu were quick to establish cultivations. However that was still combined with aspects of their itinerant lifestyle by resting lands and returning to use after being left for a period to recover.
- There is also a community garden and glass house at the marae.

Having determined that 90% of respondents do consume different types of kai:

- 40% of respondents said they now only eat kai on special occasions; while
- 18.9% eat kai less than once a month; and
- 22.3% only eat kai 1-3 times per month (Figure 18).

Figures 19 - 24 illustrate how often the various species are consumed:

- 40% of those eating eel have this food 1-3 times per month.
- It was of concern therefore that 70% of the respondents believed that there were now “a lot fewer” eels present.

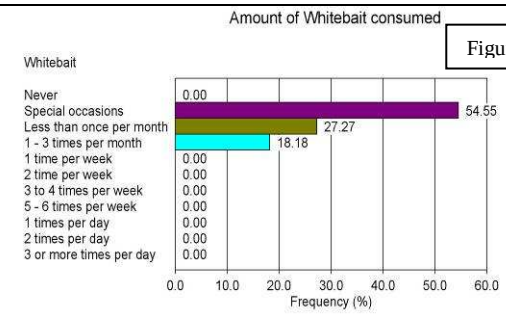


Figure 20

- For paua, whitebait, eel, flounder and crayfish at least 50% of the respondents indicate they consume these species at special occasions.

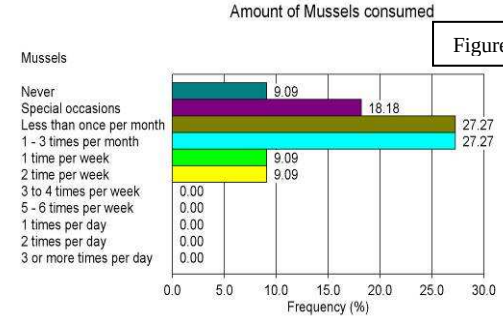


Figure 21

- Only mussels are consumed weekly – specifically once or twice per week. Interesting this is the only species that some respondents believed had increased in abundance.
- They also observed that mussels can now be easily accessed from supermarkets.

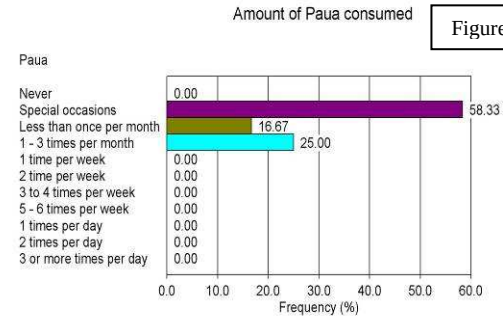


Figure 22

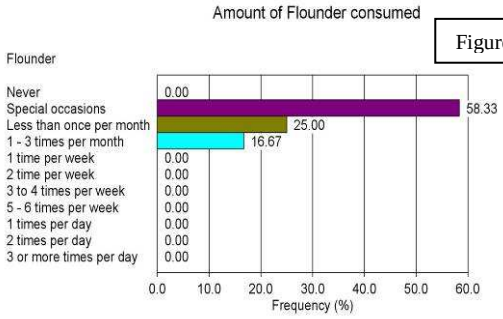


Figure 23

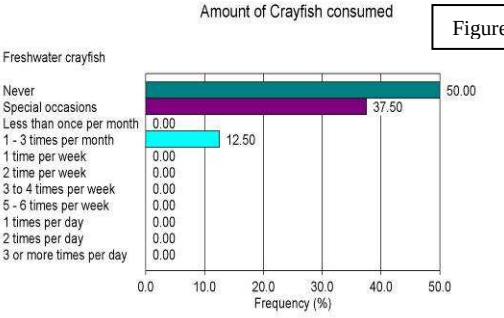


Figure 24

How respondents prepared their kai was also important. It was accepted that although many would prepare their own kai, others would purchase fish at take always, and supermarkets (as either fresh or tinned fish). Figures 25-27 illustrate the difference between age groups.

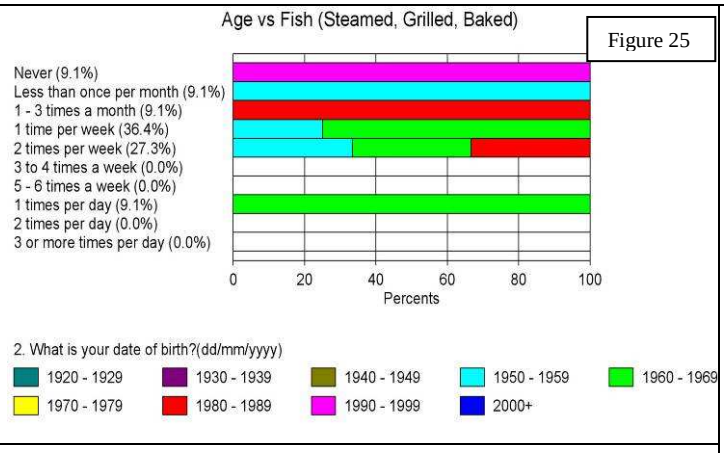


Figure 25

63.7% of respondents consumed steamed, grilled or baked fish at least 1 per week.

Today convenience foods can be purchased from a variety of sources and is available:

- As tinned fish;
- As fresh fish available in the deli of a supermarket; and
- As fish and chips at a take way store.

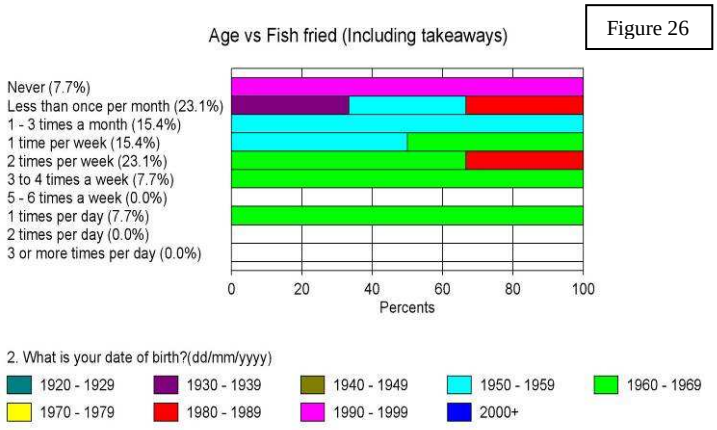


Figure 26

The graphs at left confirm that:

- Fried fish is consumed frequently and by one respondent at least once per day.
- 46.2% buy fried fish at least once a week.

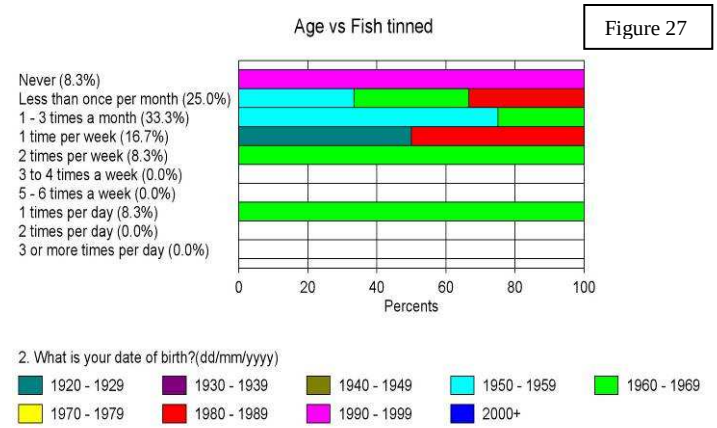


Figure 27

Interestingly Kaumatua consume fried fish less than once per month although in contrast they consume tin fish at least once a week.

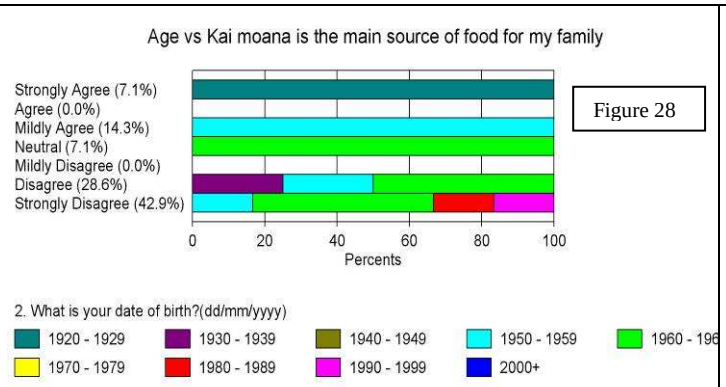


Figure 28

We wanted to determine how dependent whanau were on kaimoana. A question therefore asked if kai moana was the main source of food for the whanau.

- The oldest Kaumatua participating was the only one that strongly agreed with this statement.
- The others that agreed with this statement were aged 50-59 years. In contrast the rangatahi and tamariki participating all strongly disagreed with this statement. In fact 71% spread across four age groups disagreed or strongly disagreed – in other words kai was not the main source of food for their family.

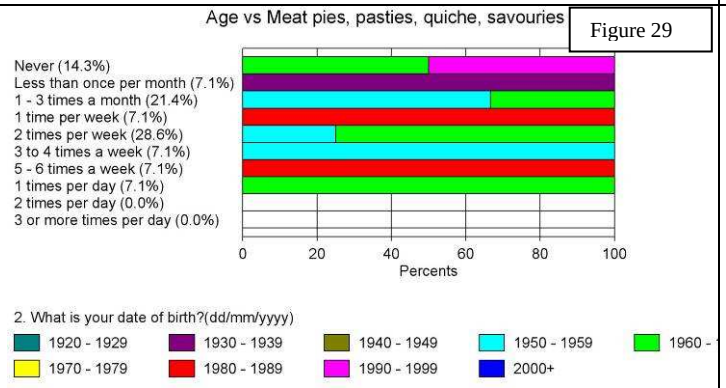


Figure 29

- Questions sought to identify changes from a traditional diet to a western style diet (Figure 29). It was of concern that 57% of respondents eat meat pies, pasties, quiche or savouries at least weekly, with 28% eating these foods twice a week and one participant eating these foods daily.

5.2.3 Estimates of the quantity of kai consumed

This research investigates the risk of contamination from eating wild sourced kai. A key consideration is the amount of kai that they are actually consuming. This is calculated by examining:

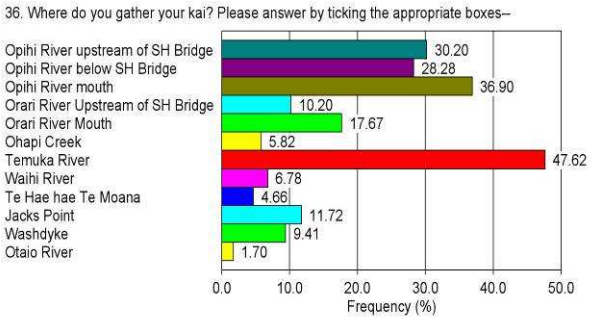
- the frequency or number of times they consume kai; and
- the quantity per sitting.

63.7% of respondents consumed steamed, grilled or baked fish at least 1 per week. From the data collected we also know that they consumed approximately 230.77 of fish per sitting. For mussels and whitebait the quantities change somewhat with participants consuming 157g and 302g per sitting.

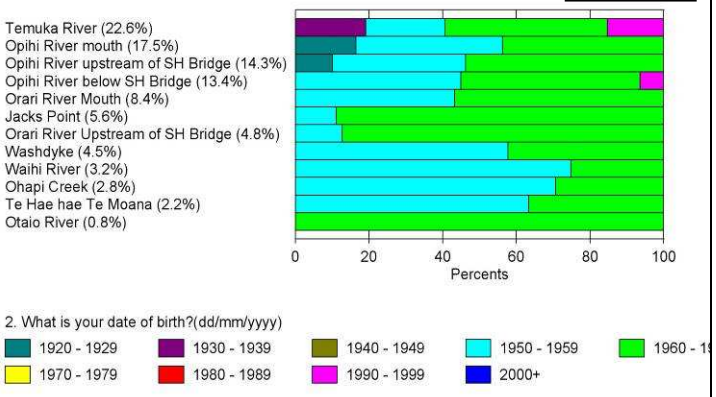
5.2.4 Sites at which kai gathering and other activities are undertaken

In addition to identifying the species gathered, the sites from which kai was sourced were identified. These sites were used as the basis for a sampling programme which examined contaminants in sediment and kai species (see Appendix 2 for site details). Figure 30 below confirms that 47.6% of participants gather from the Temuka River, while the Opihi River (upstream of State Highway 1, downstream of the State Highway, and the river mouth) are used by 30%, 28% and 37% of participants, respectively.

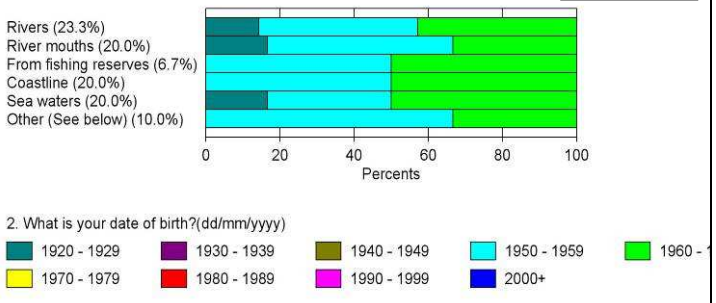
Where do you gather your kai — Figure 30



Age vs Where do you gather kai — Figure 31



Age vs Locations you gathered kai from — Figure 32



Of the sites listed in the Figures at left (Figure 30):

- There is easy access to the Opihi River and reserves at the river mouth.
- There are fishing easements on the south bank of the Orari River mouth and at Ohapi Creek.
- There is a reserve at Washdyke.

From the data collected it is also possible to identify the gathering preferences of the respective age groups (Figure 31):

- Kaumatua and tamariki fish locally from the Opihi and Temuka Rivers.
- Pakeke are the most mobile with those aged between 40-59 accessing most sites.

When identifying the reaches of a river that are fished by the respective age groups (Figure 32):

- Pakeke are the most mobile accessing most river types.
- Kaumatua limited their gathering to river mouths and coastal fishing.
- Only 6% fished from the reserves.

Figures 33 and 34 the various species that are sourced from the different waterbodies and the relative proportions of each species gathered.

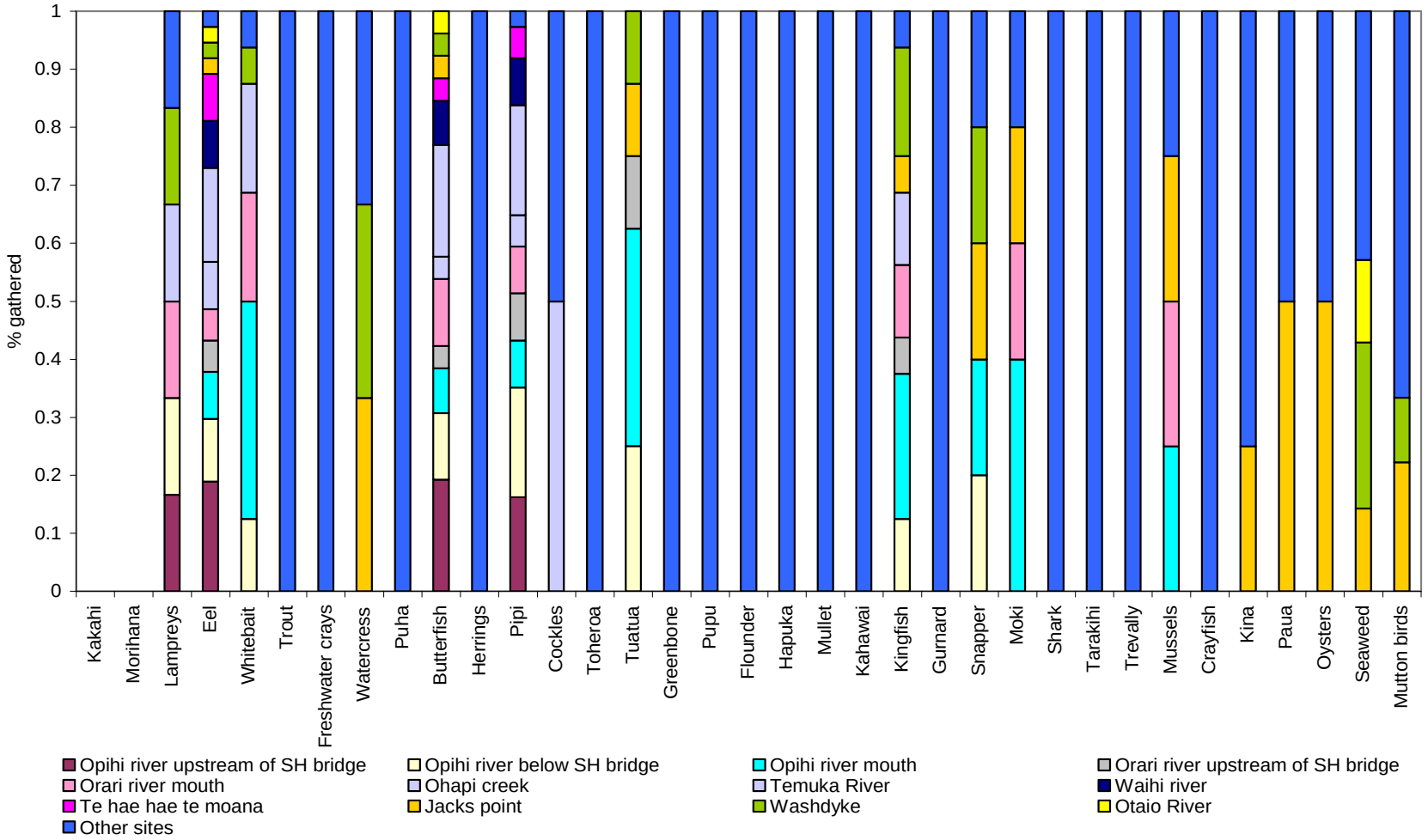


Figure 33: Relative proportions of sites from which the different species of kai were gathered.

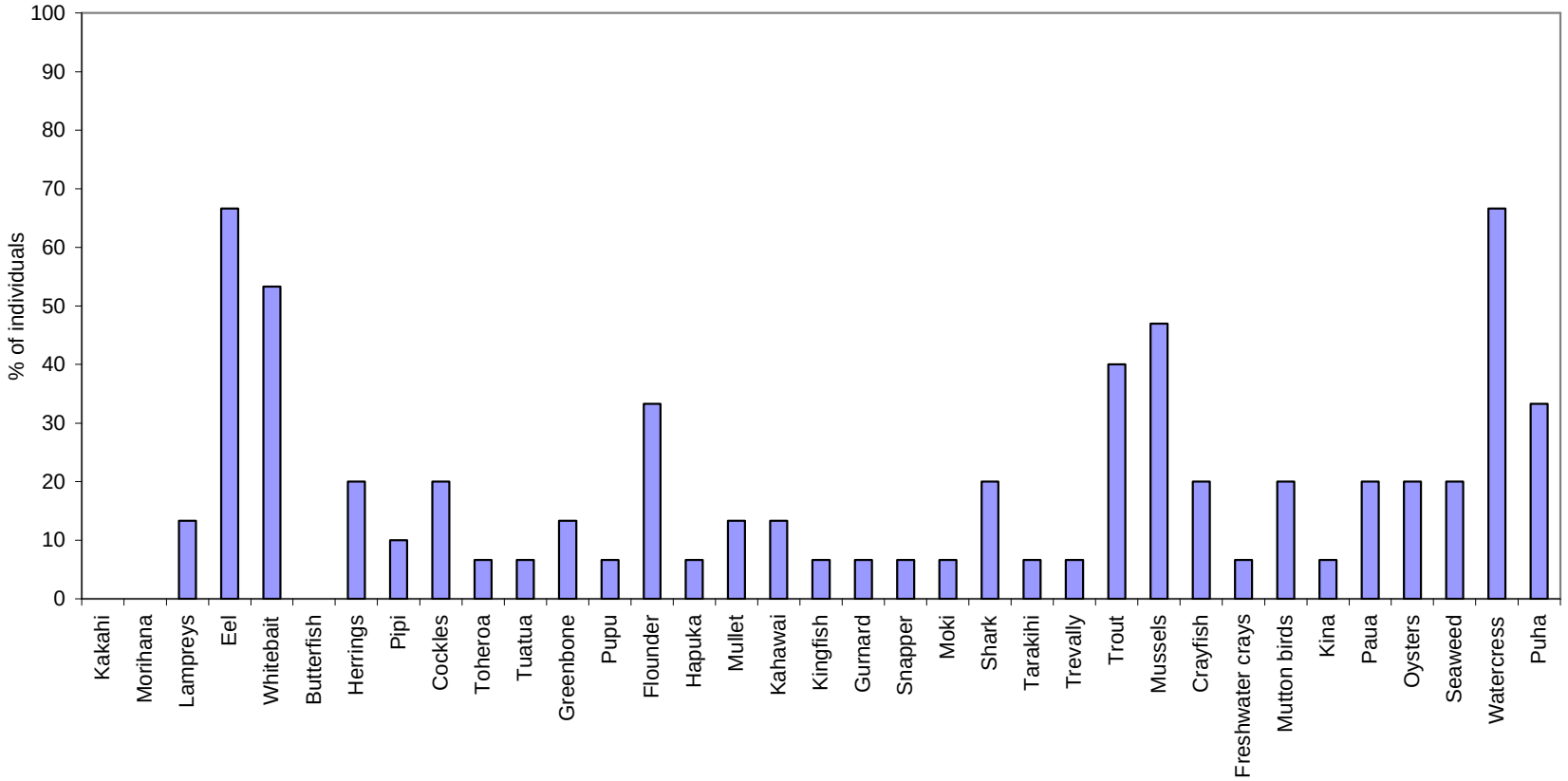


Figure 34: Percentage of individuals that gather different kai species.

In addition to gathering data about kai, data were collected about other activities undertaken at the respective sites, as contact with these waters could be a source of exposure to contaminants, rather than kai consumption. Figures 35-44 illustrate these additional activities. In summary:

- Swimming at some sites reflects their perceived high water quality.

- The two sites on the Opihi, in proximity to the State Highway Bridge, are popular for swimming with all respondents who use these sites.

- These two sites on the Opihi plus the Temuka also supported the greatest range of activities by whanau.

- The Temuka River and the Te Hae Hae Moana River are also swimming spots – again all respondents using these sites say they swim there.

- Sites that are known to be adversely impacted by activities in the catchment (and thus suffering degraded water quality) received mixed levels of use:

    - Jacks Point supports a range of fishing related activities but limited swimming (only 25%).

    - Ohapi Creek, one of the fishing easements, is used solely for fishing.

    - Washdyke, one of the reserves, is used solely for fishing.

    - Opihi River Mouth supports a range of activities but only 40% of the respondents swim there.

    - Otaio does not support swimming.

Photos are included beside each figure to give a visual depiction of the site.

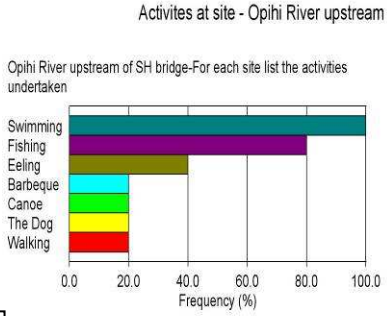
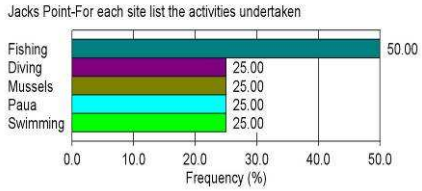


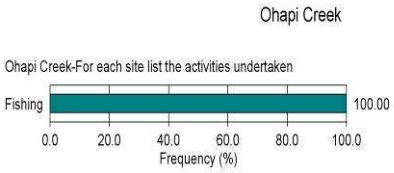
Figure 35

* Note: Multiple answer percentage-count totals not meaningful.



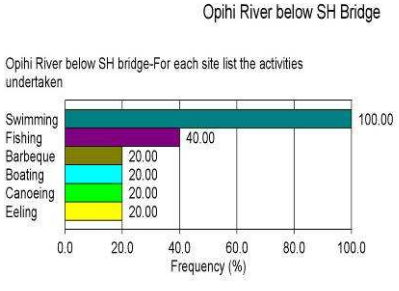
* Note: Multiple answer percentage-count totals not meaningful.

Figure 36



* Note: Multiple answer percentage-count totals not meaningful.

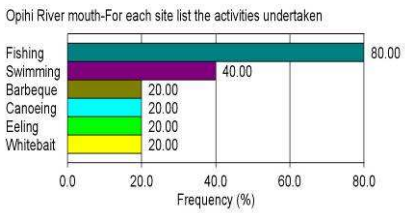
Figure 37



* Note: Multiple answer percentage-count totals not meaningful.

Figure 38

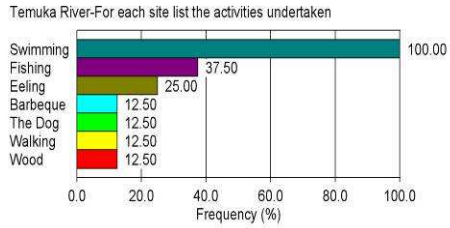
Opihi River mouth



* Note: Multiple answer percentage-count totals not meaningful.

Figure 39

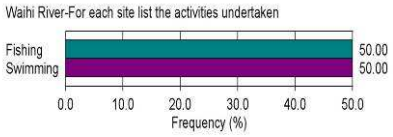
Temuka River



* Note: Multiple answer percentage-count totals not meaningful.

Figure 40

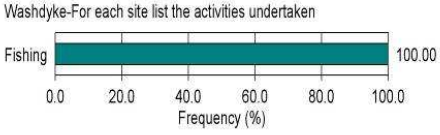
Waihi River



* Note: Multiple answer percentage-count totals not meaningful.

Figure 41

Washdyke



* Note: Multiple answer percentage-count totals not meaningful.

Figure 42

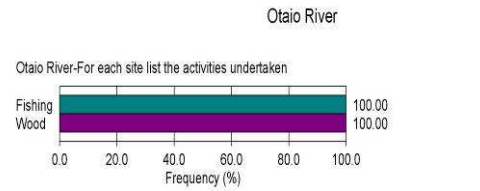


Figure 43

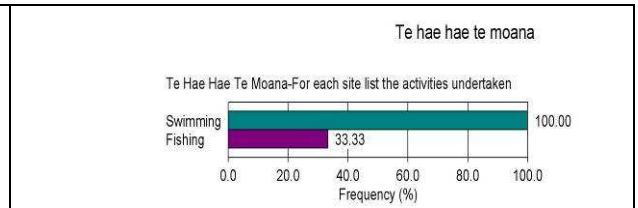


Figure 44

5.2.5 Other sources of kai

This project aims to assist the risk of exposure to contaminants associated with kai gathering. If there are concerns about the safety of kai consumed, and people are consuming kai that has been gifted, it is important to know where the kai comes from.

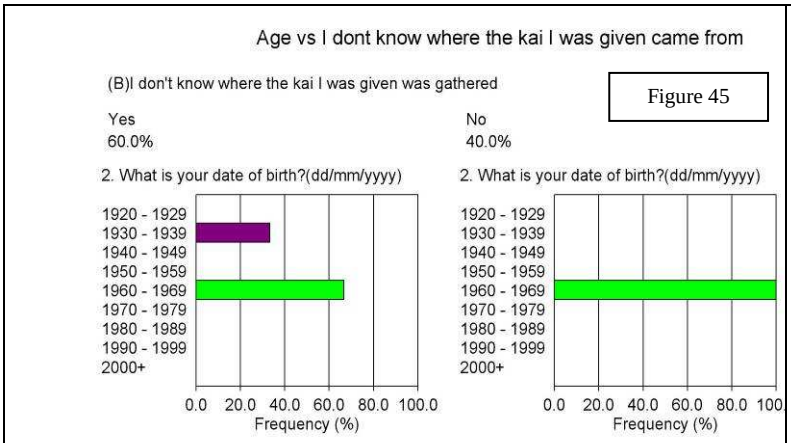


Figure 45

60% of respondents indicated that they did not know where the kai they were given was sourced.

Assuming the sites whanau gather from would change if the condition of the site was degraded; respondents were asked if they were able to gather from the sites that they have always gathered from.

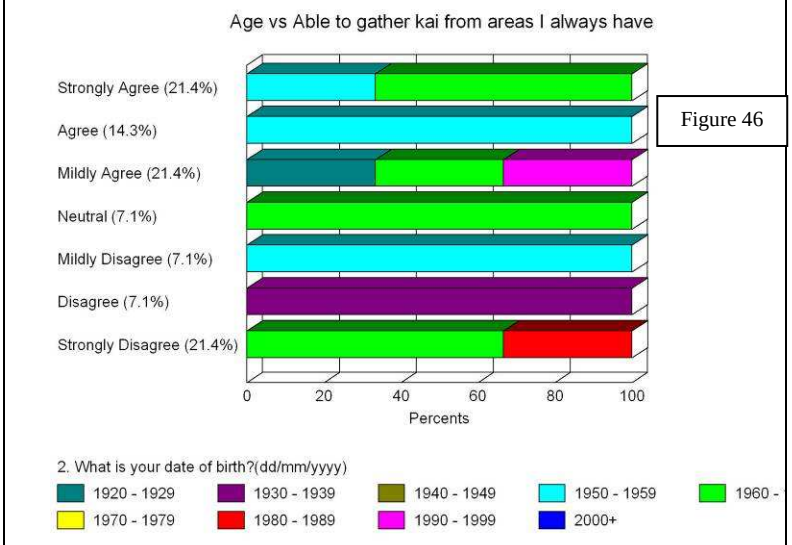


Figure 46

- 56% agree that they can.
- 35% say that they cannot.

No trends can be detected when looking at the respective age groups.

As whanau explained:

I still go there (Washdyke) on the sea side of it when it's (whitebait) in season and I still venture into the lagoon for kanakana.

We have gone as far Rangitata and Moeraki. With Moeraki always being used for paua and pupu which were gathered with Aunty and she would show us how to make kelp bag.

Paerora River was where they washed the bodies. I have just found out When we were younger we would go to the Waihao for kanakana and eels and we never touched the Paerora but I never knew why till now.

My favourite eeling spot is between the Temuka Road Bridge and the Manse Bridge and beyond. In that stretch of water when we were young we could catch around 50 eels and it was no hassle. You would see as many go past you as you spear but today in that same stretch of water you would see 5 eels that were not able to take.

Mainly around here I go to the Opihi. But lately in the last few years I wouldn't go floundering there because of the smell as the lagoon would get built up and water get stagnant and really bad smell. To me it goes to the fish and you couldn't eat it.

To Jacks Point for mussels. A lot of people gather around the wharf but I wouldn't because of all the oil and stuff that comes from the boats. I would go to Jacks Point where it's a lot cleaner.

The prime area being the Temuka and Opihi River and Awarua River (joined the Temuka straight across from the Marae). Awarua River was where we get a lot of watercress and we still do and freshwater koura. And tuna those were the basic ones we took from there.

5.2.6 Preferred kai species

Tuna was a major part of our diet. Most people didn't have the money to go out and buy food so they would use the awa as much as possible. They would go through the seasons from eeling in the summer through to March. Then move to kanakana in June / July / August in the colder parts of the season and whitebait as well. Then tuna would start to come back into season September onwards.

There was always kai around. If you couldn't get it in one place you would go to other places. If we didn't get paua here we would go down to Moeraki and if we couldn't get tuna here we would go somewhere else. It all depends on the time of year. We get patiki at certain times of year at spring time. There was always an abundance of food at that time but there was also a matter of storing it and preparing it so you could keep.

A question asked respondents to choose from the list of kaimoana, kai roto, or kai awa species those that they most preferred to eat. They were only allowed to choose their "top 6". These were to be their preferred kai.

- "1" was to be written beside their most preferred food;
- "2" was to written alongside their second choice;
- down to "6" which is to indicate their 6th preference.

Surprisingly, the top 6 preferences according to the ratings (in order of preference were):

5. snapper, koura
6. kina
7. trout
8. pupu, pipi, cockles, herrings, oysters.

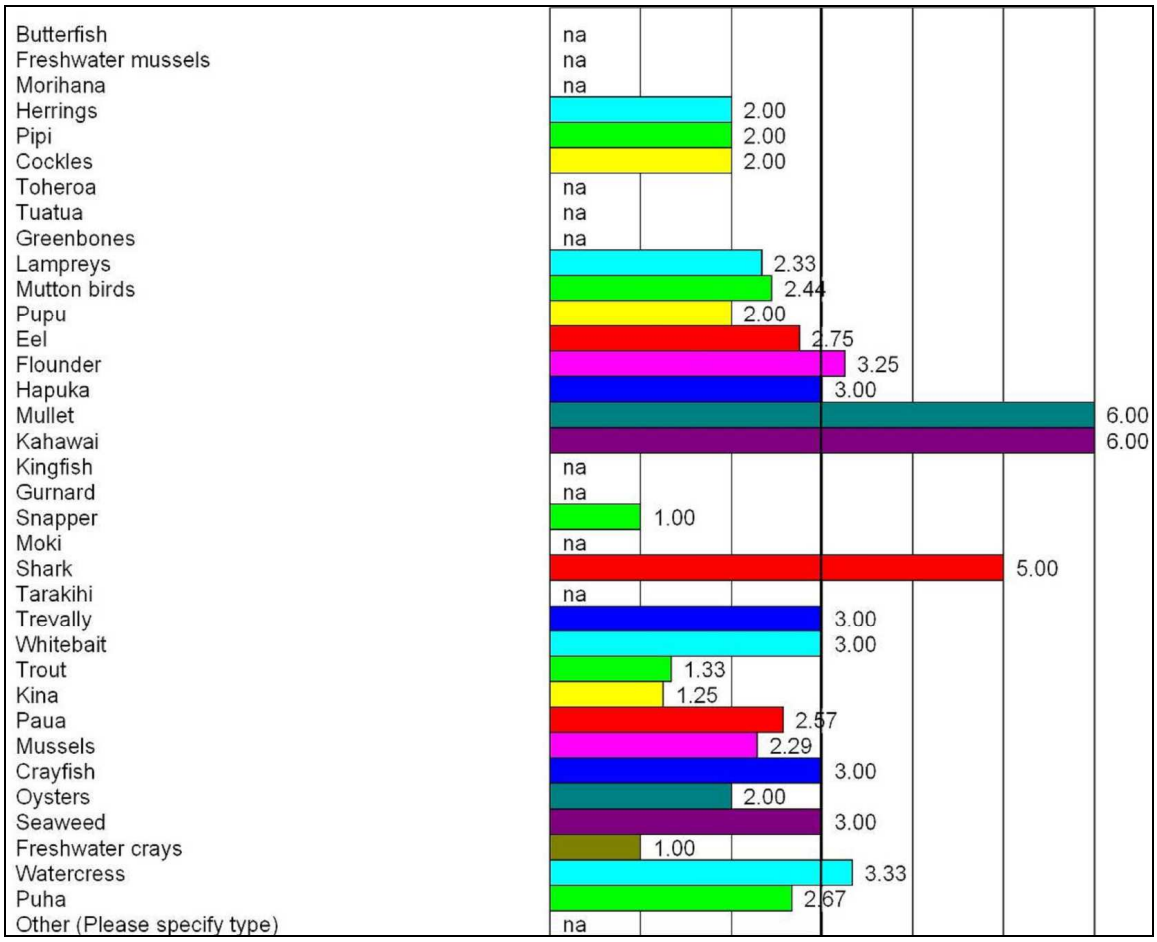
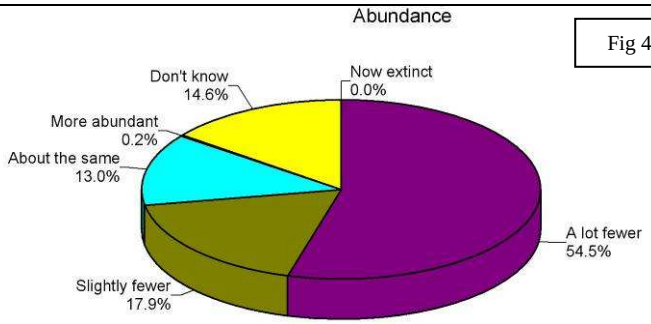


Figure 47: Preferred kai species (Numbers 0- 6 on the x axis represent the preference of whanau – 1 being the most preferred and 6 the lease preferred)

5.2.7 Perceived changes in the abundance of species that are gathered

If kai moana, kai awa and kai roto are to be promoted as a beneficial source of food for whanau, there need to be sufficient quantities of healthy stocks in order to sustain gathering. Questions in the Kai Consumption Survey asked whanau to provide their assessment of the stocks of various species gathered.



Of concern 54% of respondents believed that across all species gathered there were now a “lot fewer” available while another 17.9% believed that abundance was “slightly fewer”(Figure 47).

Table 8: Changes in the abundance of species (as a percentage)[7].

SPECIES	A LOT FEWER	SLIGHTLY FEWER	ABOUT THE SAME	MORE ABUNDANT
Butterfish	25	25	25	-
Kakahi	50	25	25	-
Morihana	33.3	33.3	-	-
Herrings	50	25	25	-
Cockles	37.5	37.5	-	-
Pipi	40	20	-	-
Toheroa	50	25	-	-
Tuatua	33	33	33	-
Greenbone	50	25	-	-
Lamprey	75	12.5	12.5	-
Mutton birds	50	12.5	25	-
Pupu	60	20	-	-
Eel	70	20	-	-
Flounder	57	14	14	-
Paua	71.4	14.3	14.3	-
Mussels	50	25	12.5	12.5
Crayfish	66.7	16.7	16.7	-
Oysters	60	20	20	-
Seaweed	66.7	-	33	-
Koura	50	25	25	-
Watercress	37.5	25	25	-
Puha	45.5	18.2	27.3	-
Hapuka	50	25	-	-
Mullet	50	25	-	-
Kahawai	50	25	25	-
Kingfish	33	33	-	-
Gurnard	33	33	-	-
Snapper	33	33	-	-
Moki	50	25	-	-
Shark	50	25	25	-
Tarakihi	66.7	-	-	-
Trevally	66.7	-	-	-
Whitebait	70	10	10	-
Trout	14.3	42.9	28.6	-
Kina	75	25	-	-

As whanau explained:

Eels have diminished in number and they are probably the last species to be affected. You were once able to get crayfish you can't get crayfish in the local area. Paua again have diminished in number and size…..We now go to Moeraki to get them or elsewhere. Same thing for mussels they are virtually gone.

[7] Perceptions with respect to individual species are summarised in Table 8 with graphs included as **Appendix 1**

There are flounders we are finding now because of the quality of water in the lagoon and unless the mouth is open constantly then the patiki is muddy are horrible to taste. We don't even bother going out when the mouth is closed. It's tainted.

Our very best catchers can't get our customary take, as you can't get it. It's down to commercial eelers. Even 10 to 15 years ago if there was a tangi you could walk from the Temuka Bridge to the Manse Bridge which is about 800m and you would get at least a full bag of eel. Now you would be lucky to get two. You may get a dozen if three or four people were out with torches.

Watercress as well, there is a lot less around and the sprays they use these days and the run off from the farms in polluting the rivers.

Whitebait has dropped off in quantity with sometimes having a reasonable season but 99% of time it has diminished and more whitebaiters. Tuna is slowly disappearing.

5.2.8 Kai gathering behaviours

It cannot be assumed that all kai consumed is gathered by the respondents. Questions in the survey therefore asked about purchasing kai and sought to understand if it was shared within the whanau and wider community.

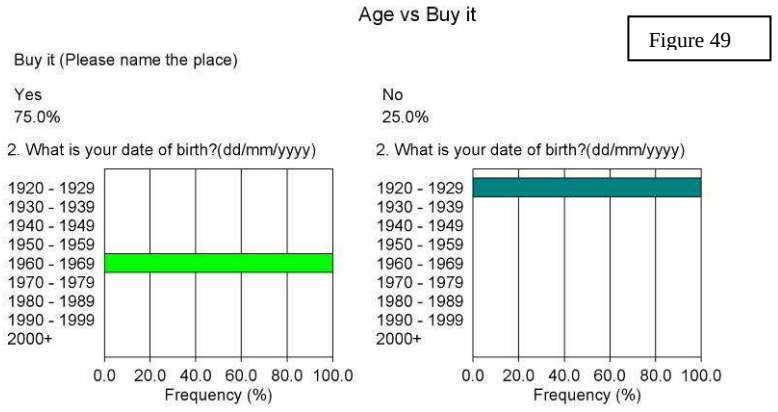


Figure 49

- 75% (all aged 40-49 years) buy some of their kai (Figure 49)
- The kaumatua did not purchase kai.

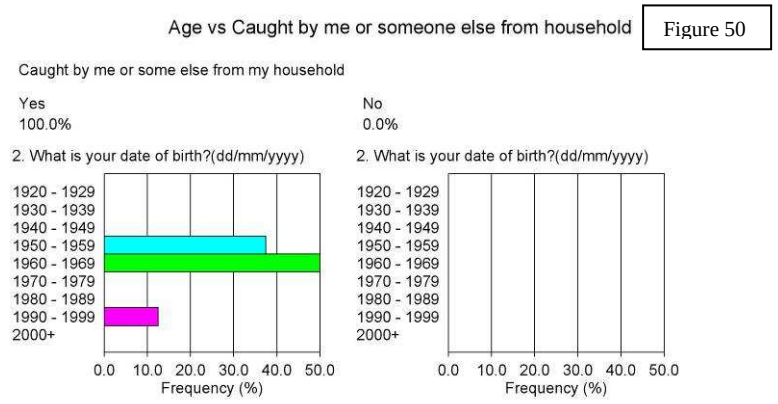


Figure 50

- Those aged 40-59 years and the tamariki confirmed that they caught their own kai (Figure 50).

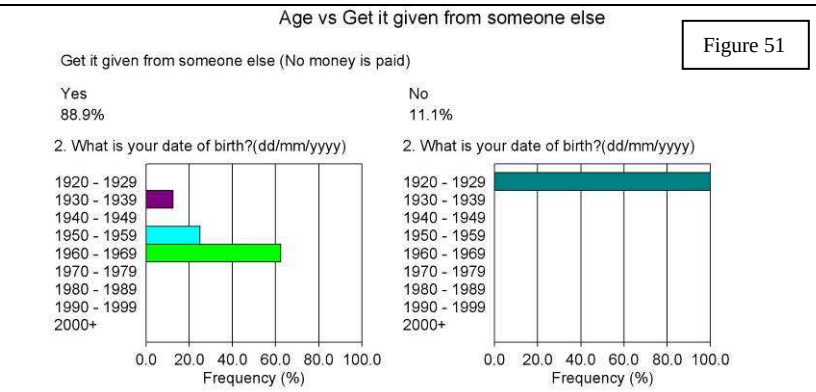


Figure 51

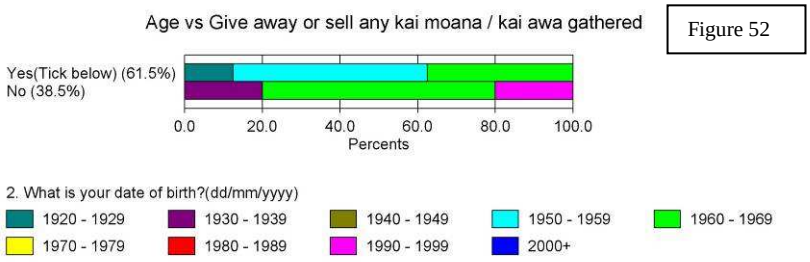


Figure 52

- 88.9% of participants said that they also were given kai (Figure 51).
- One kaumatua indicated that they were given kai from someone else as a koha while another kaumatua indicated that they were not given kai.

- 61% of participants gave away or sold some of the kai they gathered (Figure 52)

Aside from knowing how to gather kai, whanau need to know how to prepare the respective species.

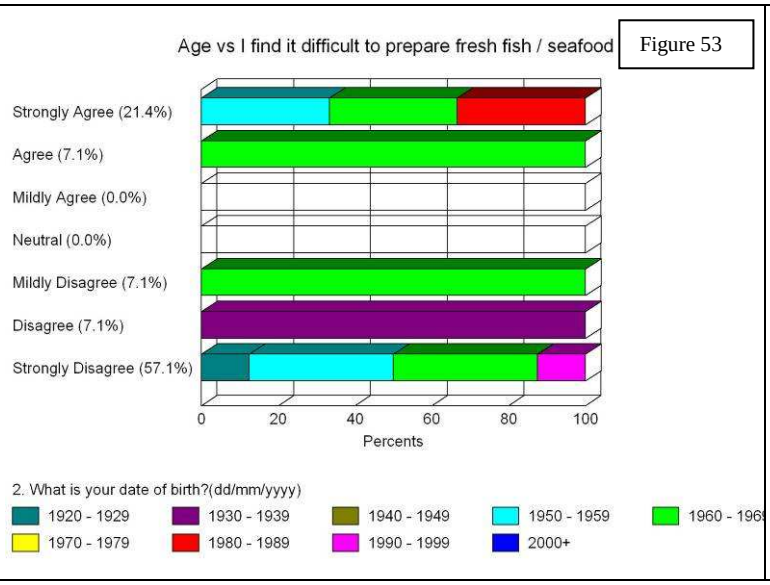


Figure 53

71% of respondents disagreed with the statement (57% strongly disagreeing) that it was difficult to prepare fresh fish and seafood. In other words 71% knew how to prepare their kai (Figure 53).

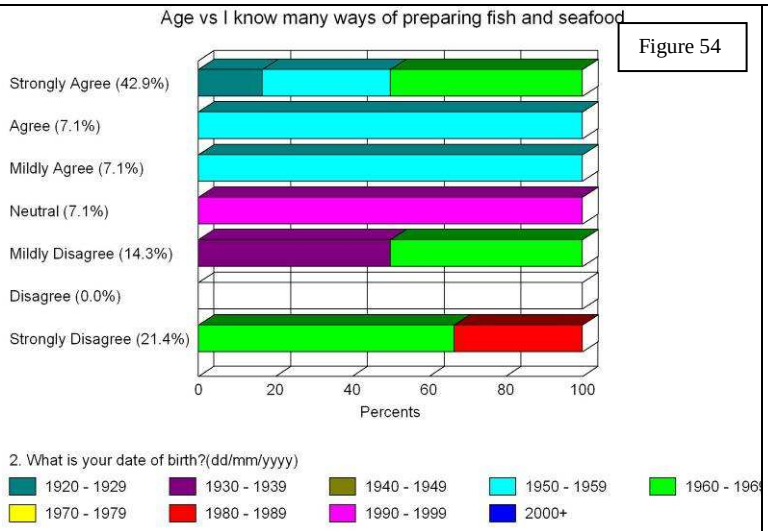


Figure 54

Of note however was the difference between generations.

Kaumatua disagreed with the statement. In contrast those: 57% of respondents (all aged 40 years and over) know many ways of preparing kai (Figure 54). In contrast and consistent with the earlier observation, those aged 20-29 years replied that they definitely did not know multiple ways of preparing kai.

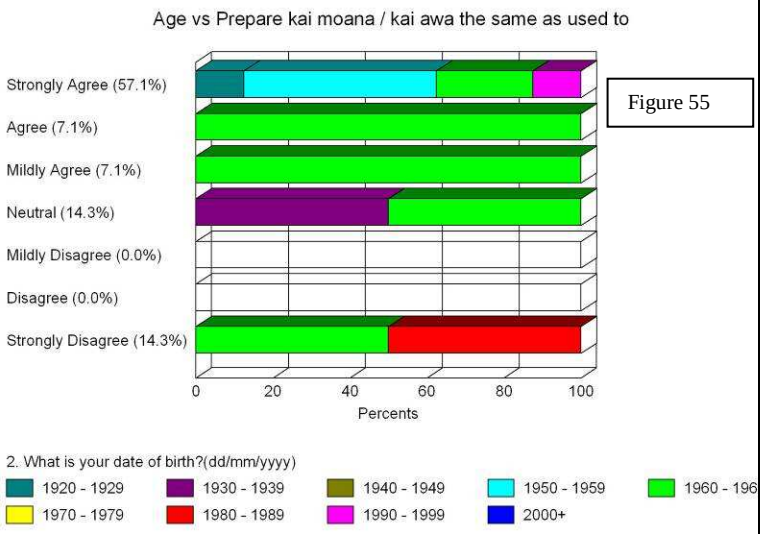


Figure 55

Interestingly Kaumatua (aged 70-79 years) also indicated they didn't really know many ways of preparing kai which could be interpreted as saying they prepare kai the same way that they have always done (Figure 55). In fact, 71% of respondents indicated they prepared their kai the same way as they have always done.

5.2.9 Perception of the environment

Maori experience environments and central to their continued interaction and utilisation of environments will be their perception of the good health of such areas. A number of questions in the survey asked for them to give an assessment of the condition of the sites from which they gather kai.

Figure 56

Responses were mixed when asked about the condition of sites (Figure 56), with:

- 35.7% believing sites to be in good condition while
- another 28.6% did not provide an assessment.
- only 28% appeared to believe that sites from which they gather are not in a good condition.

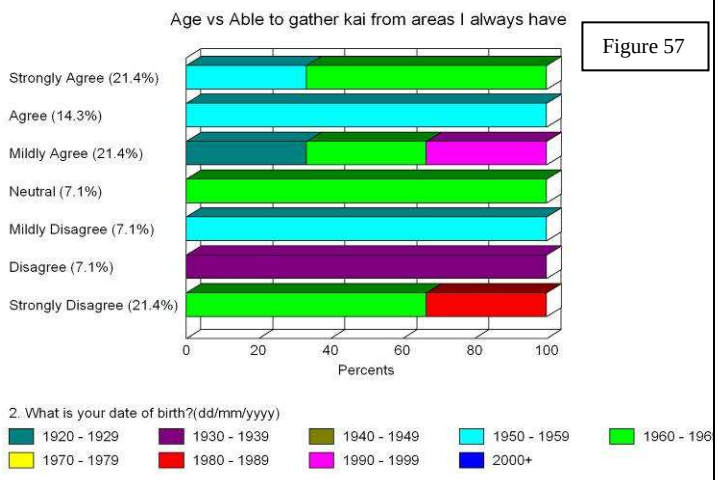


Figure 57

This is supported by the assessment of 57% of respondents (all aged 40 years and over) believing that kai could be gathered from the same sites that have always been accessed (Figure 57). An exception being a kaumatua (aged 70-79 years) who believed they could no longer gather from the sites they have previously been able to.

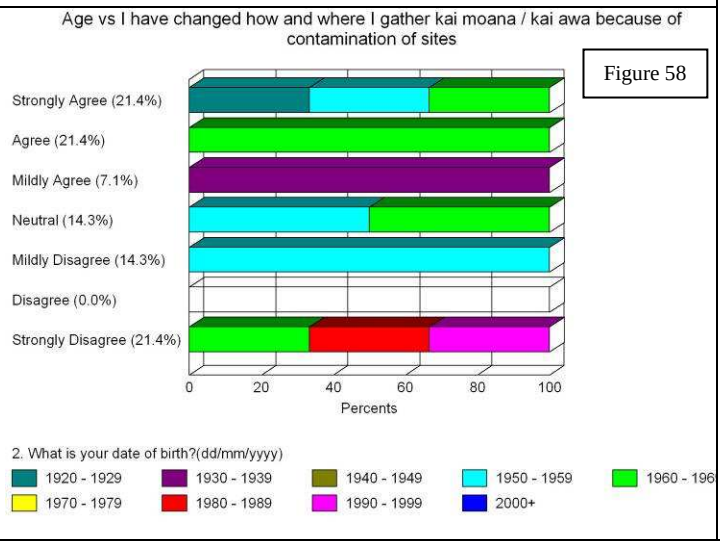


Figure 58

Responses were also mixed when asked about changing the sites they gather due to perceived contamination at the sites (Figure 58):

- Kaumatua agreed that they had changed gathering behaviours.
- 50% had changed their gathering behaviour (all of them aged 40 years or over).
- Those who strongly disagreed were all aged less than 40 years.

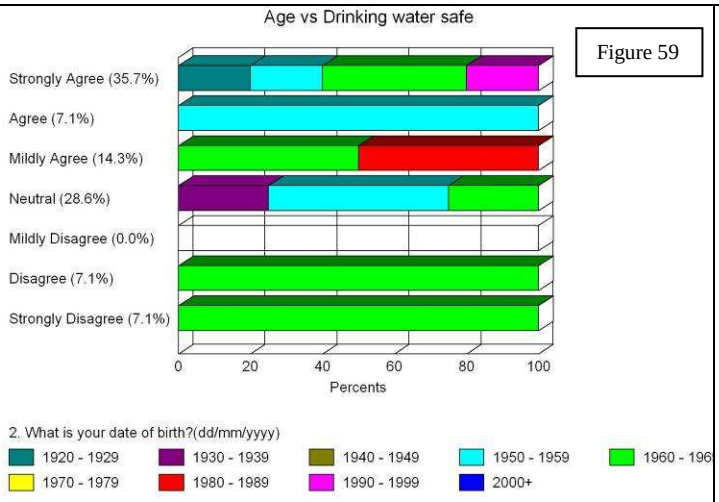


Figure 59

The majority of participants (56.8%) believed that their drinking water was safe (Figure 59). But 28.6% did not comment.

No clear trends emerged when asked if kai gathering was dangerous to the health of respondents because of pollutants or toxins.

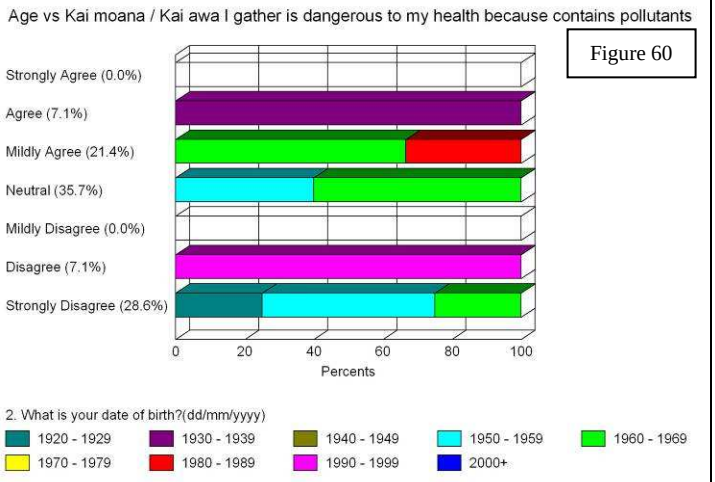


Figure 60

In relation to pollutants:

- 28.6% strongly disagreed with the statement that the kai gathered was dangerous to human health because of pollutants (Figure 60).
- However 35.7% did not provide an assessment.

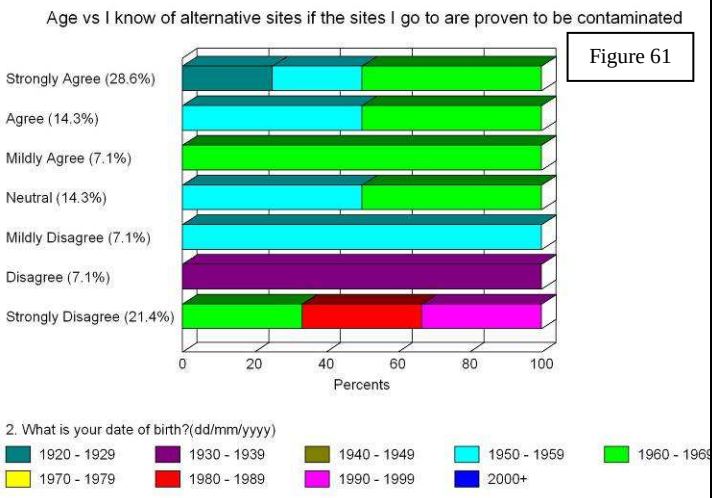


Figure 61

If a site is contaminated then the expectation would be that alternative sites would be used.

However only 50% knew of alterative sites that they could use (Figure 61). 28.6 strongly agreed.

Rangatahi and tamariki disagreed strongly indicating that they did not know how to change their behaviour and gather from alternative sites.

Whanau commented that:

The size of the lagoon has decreased because of drainage. At Temuka it used to be made up of 99% of swamplands and streams and places where eels used to be and watercress up the side but it's all drained and dry now. Creeks around the farms have been drag-lined and they

clean them out every two or three years so there is no place for the eels, no habitat and whitebait have no breeding ground. So that is why they are going down.

Washdyke we don't go there anymore because of industrial waste and if you go there it's for little as possible. You wouldn't go with all the pollution from the boats and things in harbour.

Tuna we are more worried about now because its the only thing left to us. The kanakana I go further afield because the habitat is not there anymore. The rivers are so low there is no soil banks they used to settle in to. Likewise with eel there is no real place for them anymore so their habitat has changed.

Because of low levels of river when gathering kai, like kanakana, you have to make sure the mouth is open and if its not to get same kai you have to go to Waihao.

The [taint] its worse with flounder and whitebait that's why I go to Orari now for whitebaiting. I would rather whitebait at Opihi but if water sits there for weeks and you catch it you can taste it and smell it when you eat it. Since the dams been up there the water quality down here has been bad.

5.2.10 Health of whanau members – Self Reported Rates of Diseases

Participants were asked to self report diseases prevalent in the family (Figures 62 and 63).

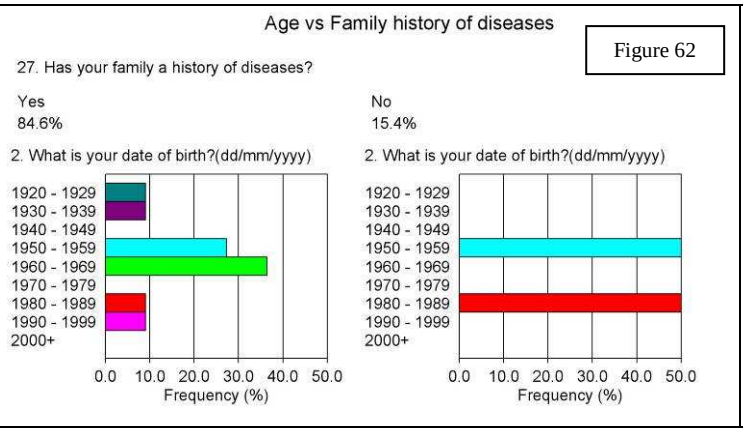
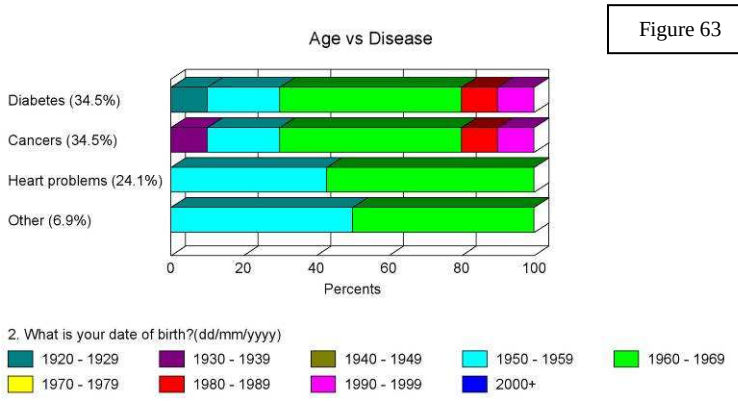


Figure 62

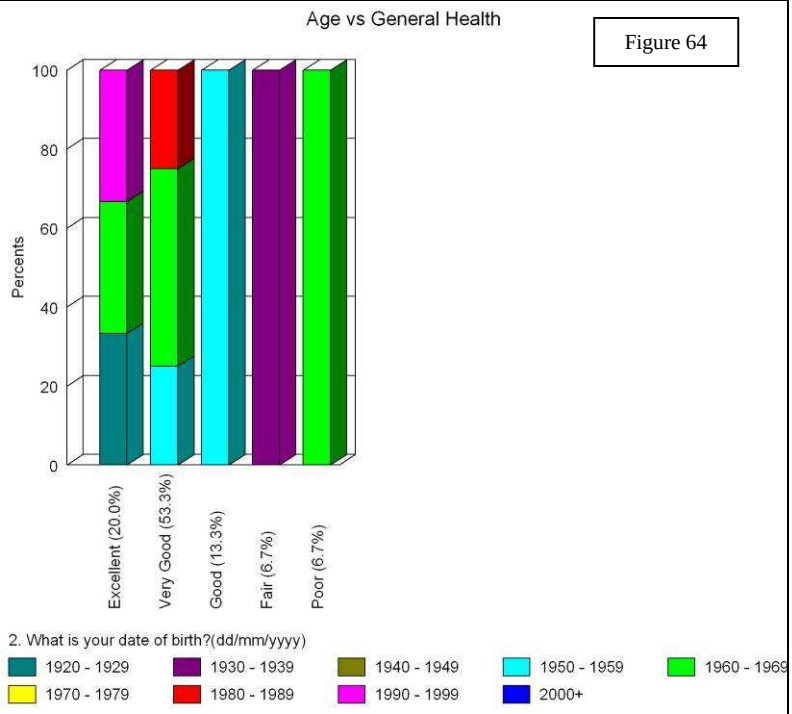
- 84.6% reported that there was a history of disease in their family.
- 34.5% of participants, across five age groups, reported a history of diabetes within their whanau.
- 34.5% of participants, across five age groups, reported a history of cancers within their family.

Figure 63



- 24.1% of respondents, all aged between 40-59 years, reported health problems.

Figure 64



Despite the prevalence of illness in their whanau (at above average rates) 87% of the individuals participating rated their health as good, very good or excellent (Figure 64). Only two of the respondents (one aged 70-79 years and the other 40-49 years) rated their health as fair or poor respectively.

Other age group observations:

- The eldest participant considered their health as excellent.
- All those aged 50-59 years rated their health as good or very good.
- The greatest variation was in the 40-49 years age group with participants rating their health poor, very good or excellent.
- As expected, the youngest participants (aged 10-29 years) considered their health very good or excellent.

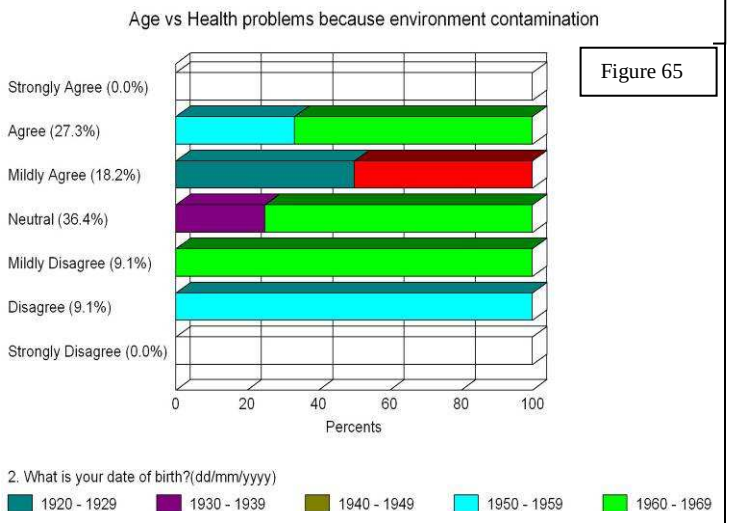
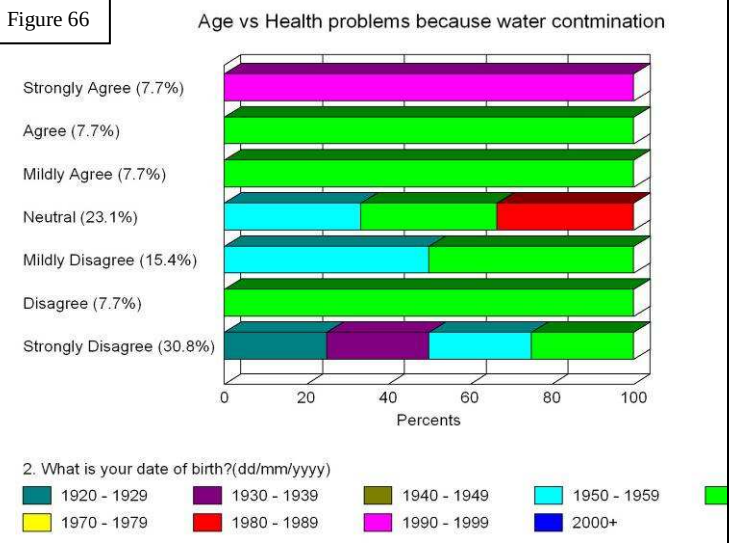


Figure 65

Two questions in the survey asked if respondents believed their health problems could be attributed to environmental contamination or more specifically water contamination (Figure 65).

With respect to environmental contamination, a third were neutral, while 45% of participants across most age groups agreed with the statement. Only those aged 40-59 years of age disagreed with the statement that their health problems were the result of environmental contamination.

Figure 66



Interestingly the majority of participants (53%) disagreed with contaminated water being the source of their health problems while another 23% provided no comment (Figure 66).

Kaumatua strongly disagreed.

5.2.11 Disseminating advice about contamination issues

One of the outputs of this research is to be a risk assessment framework. If it is to be implemented effectively it needs to reach grass roots Maori. A number of questions therefore sought data on how information should be communicated and who should be responsible for delivering the message.

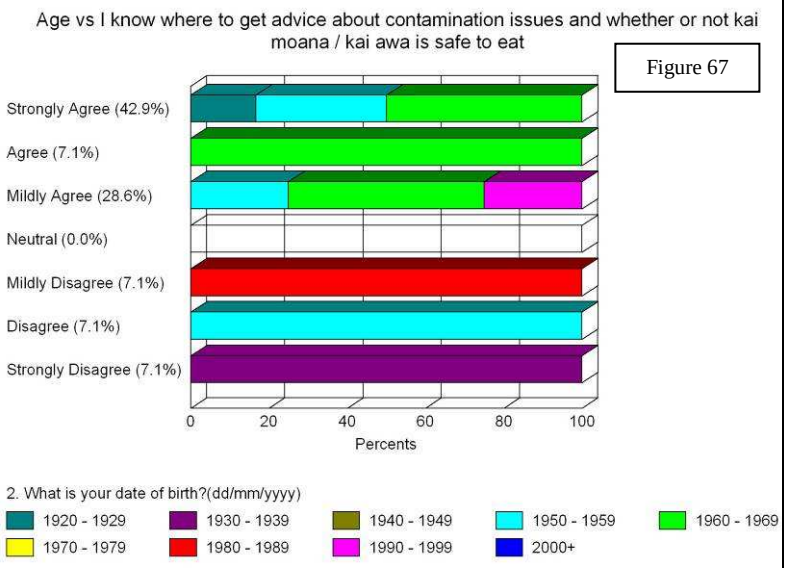


Figure 67

42.9% of respondents indicated they definitely knew where to get advice about contamination issues (Figure 67).

A further 35% responded less confidently but also said they knew where to get information from. Only 21% (and two specific age groups – rangatahi and Kaumatua) did not know where to go to obtain information.

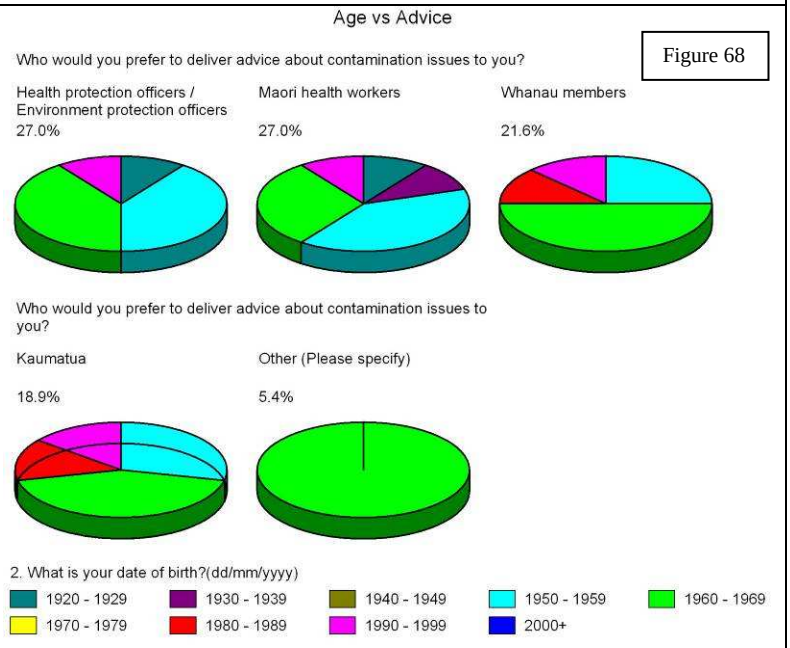


Figure 68

There is no clear preference for who should deliver the information, with similar preferences given to: HPOs/EPOS, Maori health workers and whanau members (Figure 68).

Similarly there was no clear preference with respect to the means of communicating which in fact suggests that a

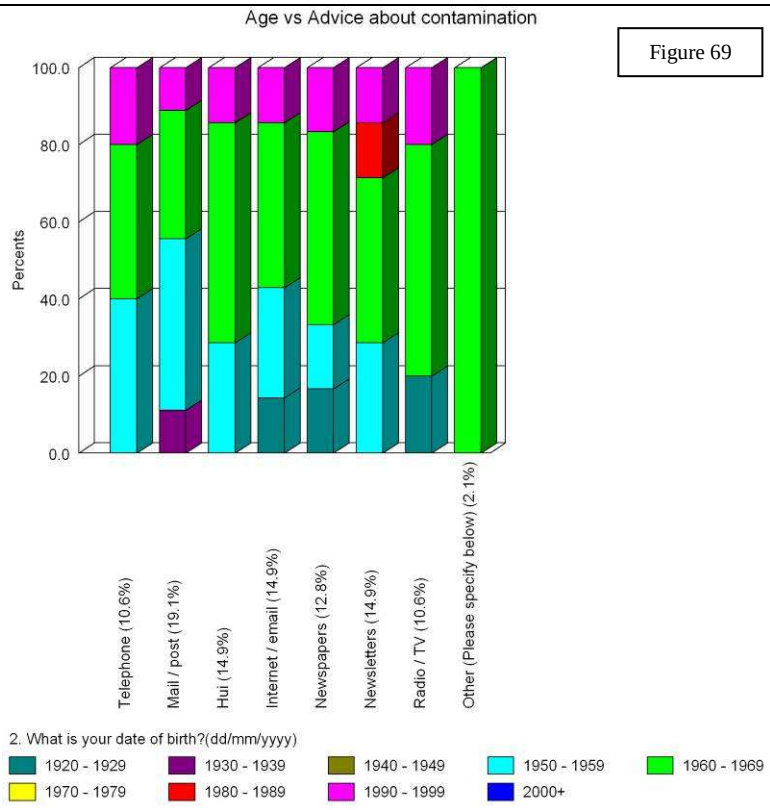


Figure 69

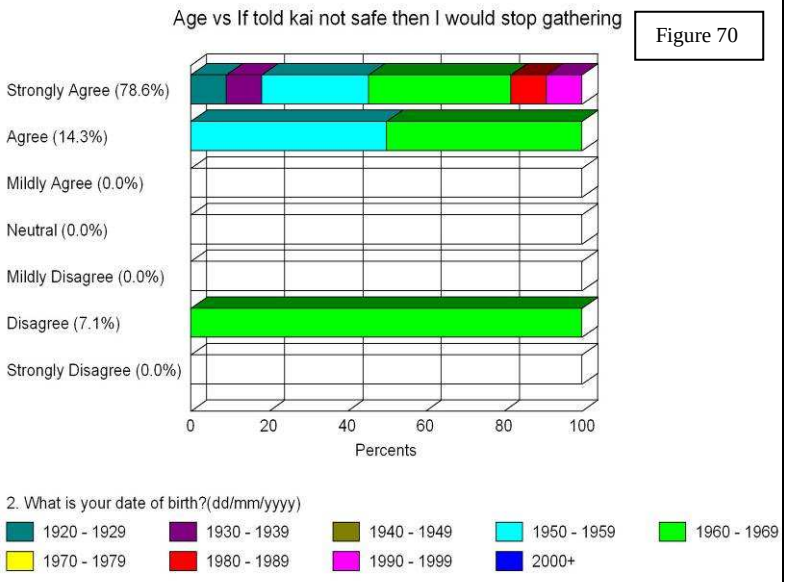


Figure 70

range of media should be used (Figure 69).

When reviewing the means of communicating we need to be cognisant of the equipment needed by whanau. Although not specific to South Canterbury, at the time of the 2006 Census:

- 66 percent of Ngai Tahu lived in a household with Internet access, an increase of 26 percent from 2001 (40 percent).
- 85 percent of Ngai Tahu lived in a household with access to a cell phone.
- 2 percent of Ngai Tahu lived in a household with no access to telecommunication devices (cell phone, telephone, and Internet or fax machine).

- The final result (Figure 70) concerns the long-term outcome of this result programme. Importantly, 93% of respondents (across all age groups) indicated they would stop gathering kai if advised that kai was not safe.

6. Discussion - understanding the socio-economic-cultural importance of kai to whanau and hapu

> *Indigenous relationships to the land are based in cultural practices. Harvesting of traditional foods is a central, material part of this relationship. A key problem for indigenous peoples occurs when, because of the practices of competing world views such as those often held by colonial states, practising these material connections becomes difficult. Problems ensue. These problems include issues related to health and well-being, and a disruption of well-established life-ways.* (Fediuk & Thom, 2003, p 1)

The discussion in this chapter re-examines traditional and contemporary consumption patterns of kai gathering, processing and consumption, the health of significant sites, and environmental change over the last 160 years to identify drivers of the transitions from a traditional kai based diet to a western diet. Insights, firstly, concerning the impact of dietary changes and secondly, the ongoing risk of exposure to contaminants and the impacts of this risk on the health and wellbeing of whanau are discussed. We have attempted to discuss these impacts in the wider political/social/cultural context in order to give a more complete reporting of cultural-environment relations.

6.1 Research results in the context of international literature

We have tried to convey the contradictions and challenges that surround the issue of contamination of kai:

1. Kai gathering contributes to the health and well bring of Maori by sustaining many cultural beliefs and values central to the identity of hapu. However the gathering of contaminated kai could be having a significant adverse impact.

2. Furgal (2003a) explains that the idea that potential health risks are associated with foods and a way of life previously regarded as “safe” has proved difficult to convey to Aboriginal peoples in North America. The individuals to whom risk information about the safety of their foods is to be conveyed have grown up living, hunting, and travelling over lands and rivers in a harsh and sometimes dangerous environment. Maori find themselves in the same situation of having to re-learn what is “safe” and what represents a health risk for them.

6.1.1 Structure of this chapter

Ngai Tahu have continually asserted their right to have their mahinga kai practices protected. However, many whanau in South Canterbury have witnessed the degradation of valued habitats and experienced significant barriers to gathering kai. They continue to express their concerns in a variety of fora. This chapter follows the format of Chapter 5 and discusses:

- patterns of kai consumption;
- estimates of the quantity of kai consumed;
- sites from which kai is gathered;
- preferred kai species;
- perceived changes in the abundance of species;
- kai gathering behaviours;
- perception of the environment;
- health and wellbeing of whanau members; and
- disseminating advice about contamination issues.

6.1.2 Patterns of kai consumption

Data from the 1879-1880 map prepared by Ngai Tahu Kaumatua was discussed in Chapter 5. This manuscript identified sites from which kai was gathered. This manuscript detailed of over 100 resources that were utilised. Analysis of the 1880 manuscript enables us to distinguish the following species sourced in South Canterbury. Of the 38 species identified there were:

- 3 species of shellfish
- 6 species of other freshwater fish
- 7 species of marine fish
- 3 species of birds

- 2 species of sea mammals
- 12 species of plants
- 5 ‘other’ species

Maori who relied directly on their knowledge of lands and rivers within their takiwa for food had access to aquatic species (eels, kanakana, waterfowl), terrestrial species (wild plants, berries, roots, and pollen), and the small game (e.g., rats) that were plentiful and sustained whanau and hapu. Figure 6 showing the location of reserves and easements depicts the scale of loss experienced by Maori following settlement. Historically a surplus of food was gathered as surpluses enabled whanau to access other resources through bartering, trading and gifting (and setting up reciprocal obligations). During the year whanau visited neighbouring hapu, taking surplus food to share. The practice of kai-hau-kai was a central feature of Ngai Tahu culture. Being able to gather abundant foods and thus able to engage in a range of economic practices ensured whanau had access to a variety of foods. Because of trade, however, people weren't restricted to kai immediately available to them from their local area but had access to a wide range of foods. When compared to the range of sites in Figures 4 and 5 it is apparent that Maori were denied access to a significant percentage of their traditional sites of kai gathering across South Canterbury and limited to a number of small reserves and easements located in the lower reaches of streams.

Indeed, many of the valued species gathered historically that were of high nutritional value are no longer available in quantities sufficient to enable them to be a primary food source. As Table 8 confirms most species are seen to be a “lot fewer” in abundance and many iconic species are now only consumed on special occasions. When the perception of species abundance is coupled with the species most commonly gathered in Table 3 and the preferences shown in Table 7, the decline of the eels resource is of particular concern. Sadly as one informant advised, kai is also often purchased for these special occasions – not gathered. Further, the condition of the kai may be compromised as well. Most distressing and representing a significant cultural loss, is the loss of entire species e.g., grayling, koura from some streams, weka.

While whanau made use of many species, the centrality of eels as a critical food source in South Canterbury is well known and reflected in the many initiatives across Te Wai Pounamu to restore populations. As Table 3 shows 72% of sites yielded eels. The current threatened populations of eels, especially longfin, contrasts with their abundance historically. Although some resources were gathered seasonally, historically whanau relied on eel year round.

Food security implies adequate access to affordable, high quality foods that are culturally acceptable. Although Table 3 showed that turnips and potatoes were grown by whanau once they were introduced to the south, this needs to be placed in context. Introduced crops could be grown in the south and a number of cultivations were established.

However, as explained in Chapter 5 introduced aquatic species were not seen as favourably and as the witnesses to the Waitangi Tribunal confirmed, introduced aquatic species were not seen by Ngai Tahu as substitutes of equivalent cultural, spiritual or nutritional value. It was therefore of interest that trout was noted as a preferred species by some respondents in the Kai Consumption Survey.

However if this is the abundant species and requires less catch effort than the declining indigenous species gathered historically, it is inevitable that some substitution occurs. It is clear from our research that whanau currently gather kai at quantities less than they did historically and at quantities less that they desire. This is discussed in the next section.

> *For eels. Full moon or any moon is out then you don't go out. If the moonlight touches the eel then it goes bad before you eat it so we don't go out during moon time.*
>
> *We restrict where we get kai like the wharf area or the outlet for sewage system or Temuka where the old wool scour was or where the settling ponds are because they sometimes overflow so we don't gather there. Or at the site where Temuka dump was we didn't gather.*
>
> *When at moana you don't eat the kai where you gather it and there are sites you avoid.*

6.1.3 Estimates of the quantity of kai consumed

There is little data available to enable calculation of pre-European contact per capita consumption of kai. Even if it was possible to determine harvesting levels for particular species, it is difficult to calculate how much food (and what species) on top of this would have been received as a gift or obtained through trade. For the calculation set out below in Table 10 we have assumed that historically fish would have been consumed on average once per day.

From interviews we know that wild source kai was consumed "at least 3 times" per week up until the 1970s and 1980s. Some whanau, however, eat kai daily. However a crucial time period – around the 1970s and 1980s – marks a significant change in the quantity of kai consumed as interviewees confirmed that more convenience foods

started to appear in whanau diets. Again to enable a calculation of kai consumption in the mid twentieth century we have assumed kai was consumed 3 times per week.

With respect to contemporary consumption, from the Kai Consumption Survey, 90% of respondents still consume kai awa, kai roto, or kai moana. For the comparative analysis in Table 10 we have extracted the quantities of fish consumed from the Kai Consumption Survey data as well as the frequency data (from Figure 25).

Table 10: Estimates of the quantity of kai consumed.

KAI CONSUMPTION HISTORICALLY	KAI CONSUMPTION UP IN TWENTIETH CENTURY 1970S, 1980S	CONTEMPORARY KAI CONSUMPTION
Assumptions • The data for estimating the quantity per sitting is that relating to "fish fillets[8]" • At least one meal of "wild kai" per day per person • Because of the abundance compared to the present, at least 10% more per setting would be compared to today's per sitting estimates 230.77 g per sitting per day Plus 10%	Assumptions • The data for estimating the quantity per sitting is that relating to "fish fillets" • At least 3 meals of "wild kai" per week per person • The quantity per sitting would be the same as today's per sitting estimates of 230.77 g	Assumptions • The data for estimating the quantity per sitting is that relating to "fish fillets" • The quantity per sitting would be the same as today's per sitting estimates of 230.77 g • Special occasions are estimated to be 6 per year. • 9% eat kai on special occasions • 9% eat kai average 2 times per month • 36.4% eat kai once per week • 27.4% eat kai twice per week.
Equals 253.85g per person per day	**Equals 98.90g per person per day**	**Equals 43.81g per person per day. This is higher than the average New Zealand consumption of 32.87g per person per day (Kim and Smith, 2006).**

The quantities for other species are considerably less.

- Contemporary consumption of whitebait — **Equals 7.48g per person per day**
- Contemporary consumption of mussels — **Equals 11.14g per person per day**

The Kai Consumption Survey asked respondents to identify quantities of various types of kai consumed. For the preferred species, as recorded in Table 6 the following observations can be made:

- The quantities available fall far short of levels desired by whanau who wish to engage in mahinga kai practices. The only two species that possibly approach

[8] It is assumed that the "fish fillets" estimate would apply for butterfish, greenbone, kanakana, eels, founder, hapuka, mullet, kahawai, kingfish, gurnard, snapper, moki, shark, trevally and trout.

adequate abundance are mussels and shark which respondents confirmed were available and often sourced from the supermarket or takeaway.

- It can be seen from Table 7 that for almost every species, the majority of respondents believed that populations were declining.

- The majority of kai is now only consumed on special occasions.

6.1.4 Sites at which kai gathering and other activities are undertaken

Major changes in mahinga kai behaviours began some 160 years ago with European settlement. Newly introduced foods replaced wild sourced kai principally because of the relocation of whanau and hapu to reserves, their assimilation in the mainstream New Zealand culture, and damage to the resource base resulting from use and development of resources by the newly arrived settlers. Interestingly many of the sites still utilised by whanau as shown in Figure 30 are found in close proximity to reserves and easements.

Although the initial loss of land occurred in the mid eighteenth century the interviews with whanau members (especially kaumatua) confirmed that they gathered many species until relatively recently and they believed that the most damaging changes occurred within the last generation. These observations confirm the period of 1970-1980 as a time of change.

The alienation of lands and resources has seen the mahinga kai practices of Ngai Tahu transformed. This transformation occurred at a time when resource degradation and environmental crises have precipitated the search for alternatives to dominant management systems (Berkes, 1991, 1994; Pinkerton, 1989; Stevens, 1998). Traditional knowledge, (or in the New Zealand context Matauranga Maori) is increasingly promoted as a valuable addition to scientific knowledge. However it must be recognised that the application of Matauranga has been disrupted and subject to interference. Nevertheless for some whanau, for some resources, in some areas, there has been regular, relatively uninhabited resource use through the generations. As the interviews and Kai Consumption Survey show many Ngai Tahu continue to gather and consume kai awa, kai roto and kai moana.

The fact that kaumatua contend that the most damaging changes have occurred in the current generation, when considered alongside the data showing that the 10% of respondents who don't eat kai are all rangatahi, suggests the assimilation of Maori into mainstream New Zealand lifestyles and diets is continuing. It also suggests that the loss of some mahinga kai practices may be quite marked in younger whanau members.

In South Canterbury, the declining abundance of aquatic species at many sites is attributed to water quantity issues arising because of excessive extractions, changes in flow patterns as a result of damming, and demands to divert or drain waterbodies. This clearly has the potential to place Ngai Tahu in confrontation with development interests as:

- the streams valued and utilised by Ngai Tahu are those most stressed;
- currently 88% of water allocated in Canterbury is used for irrigation; and
- Ngai Tahu believe some of the current land uses (that are totally dependent upon water supply) are unsustainable.

Two graphs from the Canterbury Strategic Water Study (Lincoln Environmental 2002) highlight the concerns of Ngai Tahu. Figure 71 shows that for irrigation, the Orari / Opihi catchment provides 5.7% of the total maximum allocated weekly rate of take. Yet as Figure 72 which follows shows, collectively the Orari and the Opihi represent only 1.3% of Canterbury's surface water resources under low flow conditions.

From Figures 35 to Figures 44 in Chapter 5 it is clear that many of the sites utilised by whanau are found in these catchments. Another more extreme example has the Ashburton providing 19.6% of the total maximum allocated weekly rate of take, while representing only 2.4% of Canterbury's surface water resources under low flow conditions.

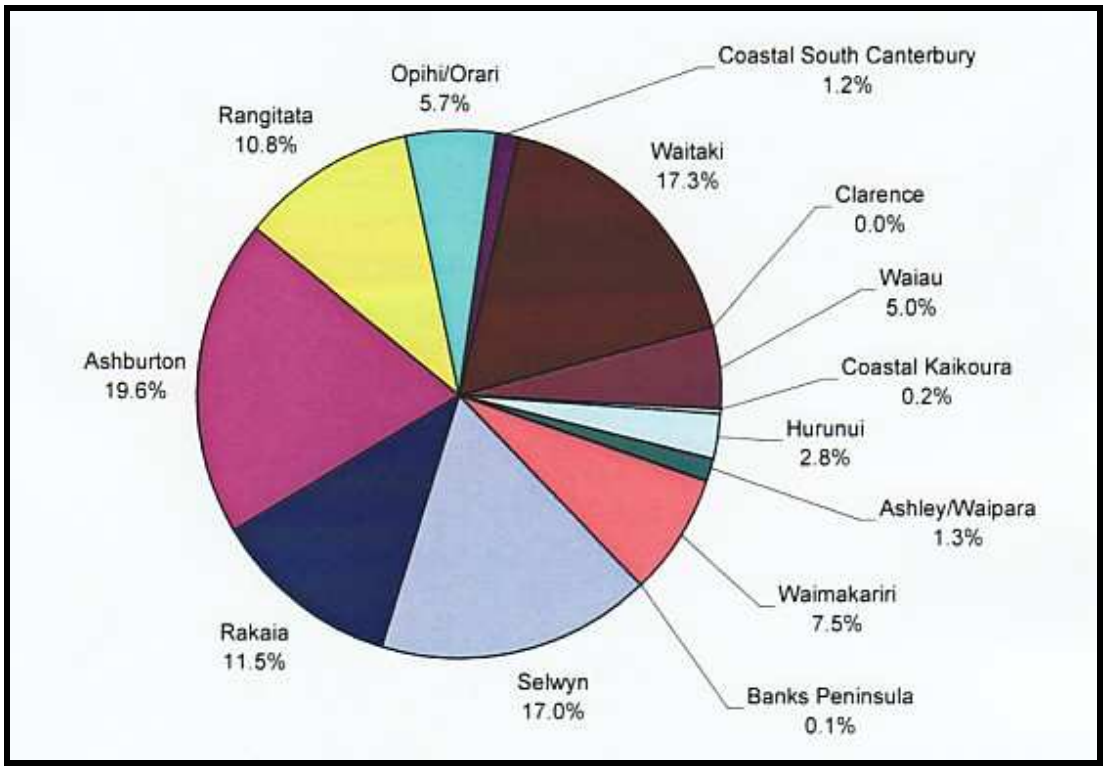


Figure 71: Proportion of total maximum allocated weekly rate of take that is supplied by each of Canterbury's water resource zones (Source: Lincoln Environmental 2002).

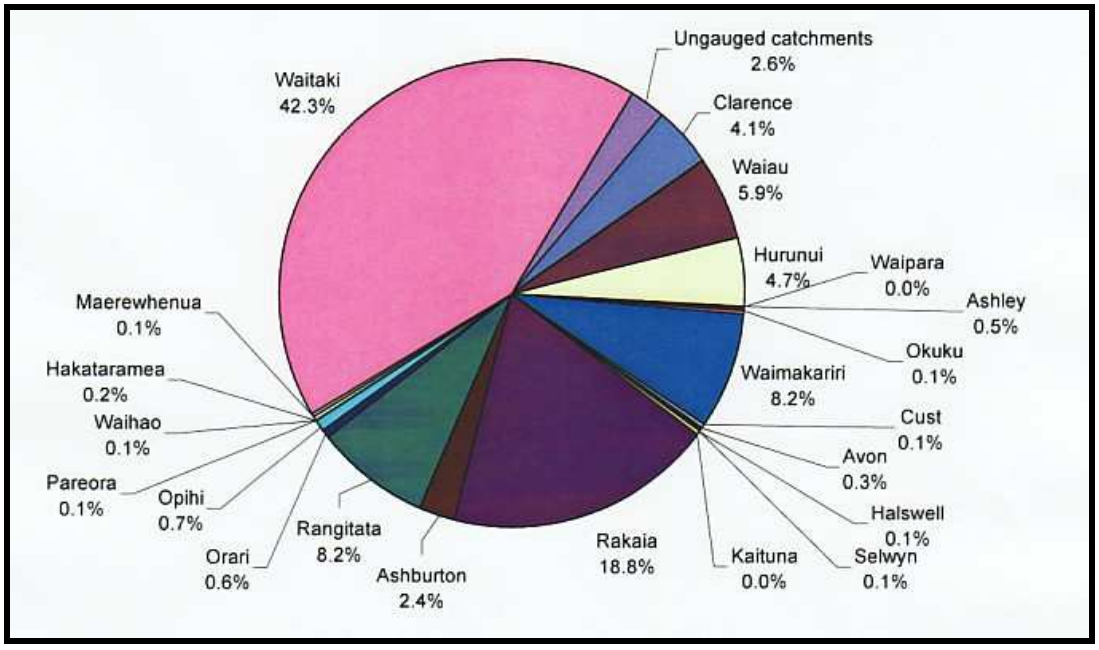


Figure 72: The relative size of Canterbury's surface water resources under low flow conditions (Source: Lincoln Environmental 2002).

While the previous two figures focused on surface water, Table 9 summarises the allocation of groundwater in the respective catchments and also confirms that the smaller catchments used and valued by Ngai Tahu are stressed.

Table 9: Revised Groundwater Allocation Summary[9]. **Issued** = granted consents outside any appeal or objection period. **Decided** = granted consents in the objection or appeal period, and consents that have been objected to or appealed. **In process** = applications for which no decision has yet been made. Total amount of groundwater currently allocated exceeds the allocation limit. Total amount of groundwater currently allocated is 80% of the allocation limit. Total amount of groundwater currently allocated is less than 80% of the allocation limit.

Zone	Allocation limit (million m^3/yr)	Effective allocation (million m^3/yr)				Zone status	
		Issue	Decided	In process	Total	Current & decided	In process
Ashburton River	69.5	69.41	0.00	10.17	79.58	100%	115%
Ashburton-Lyndhurst	126.6	128.79	0.00	8.25	137.03	102%	108%
Fairlie	37.0	4.58	0.00	0.00	4.58	12%	12%
Levels Plain	32.9	24.84	0.24	0.00	25.07	76%	76%
Makikihi	18.05	18.06	0.00	0.00	18.06	100%	100%
Mayfield-Hinds	148	125.68	0.00	5.09	130.77	85%	88%
Orari-Opihi	71.1	71.01	0.00	0.64	71.65	99%	101%
Otaio	4.93	4.76	0.00	0.00	4.76	97%	97%
Pareora	9.38	9.79	0.00	0.54	10.34	104%	110%
Parnassus	12.8	5.49	0.00	0.00	5.49	43%	43%
Rangitata-Orton	42.5	43.99	0.00	2.85	46.84	104%	110%
Valetta	96.6	106.10	0.84	29.41	136.34	110%	141%
Hook	2.49	2.87	0.00	0.80	3.67	115%	148%
Waimate	8.18	7.79	0.00	0.92	8.70	95%	106%

Interviewees believed that summer withdrawals leave some stretches of riverbed almost dry. The water is left dribbling in channels and gets lethally warm and polluted with agricultural runoff. Fish migration – upstream and downstream – is also severely compromised. In some catchments fish survival is dependent on access to isolated and disconnected large pools. Of particular relevance to consideration of contaminant levels, is the reduced assimilative capacity of waterways when only minimum flows are maintained – often for significant periods of time during summer.

[9] Sourced: Environment Canterbury http://ecan.govt.nz/services/online-services/monitoring/groundwater-allocation/Pages/groundwater-allocation-summary.aspx downloaded information was last updated 2 August 2010.

Interviewees expressed concern that both the regional council and Government seem to support and prioritise the beneficial use of water. Water has been allocated for agricultural purposes and these rights are defended vigorously. In contrast, non-agricultural purposes, such as leaving water instream to protect instream values, was and is still designated by some as "wasteful"[10]. From the perspective of Ngai Tahu the prejudice in favour of agricultural usage is still enforced. It is interesting to note that with respect to surface water flows, the following rivers are classified by Environment Canterbury as flow sensitive[11]:

- Opihi
    - Opuha (inflow to the lake).
    - Opihi.
    - Temuka River (Hae Hae Te Moana).
    - Kakahu River (upstream of Hall Road).
    - Tengawai River (whole catchment).
- Otaio – mainstem upstream of Otaio Gorge plus St Andrews Stream.
- Pareora River – catchment upstream of Pareora Huts and Taiko Stream.

Of concern when reviewing Figures 70 and 71, together with the summary of groundwater allocations in Table 9, and the list of flow sensitive surface waters are the catchments that are flow sensitive is hat many appear to be fully allocated or over allocated. To reiterate, all catchments that are valued and utilized as mahinga kai by Ngai Tahu are affected by low flows.

Other evidence to the Waitangi Tribunal by Ngai Tahu describes fish kills in rivers, while interviewees describe changes in the water quality and a deterioration of the condition of kai gathered. Decreased water quality is definitely a cause of denied or limited access to kai. Fertilisers and agricultural pesticides used in agriculture, especially the intensive agriculture of South Canterbury add to the deteriorating water quality. Table 10 summarises current water quality for some of the river used by whanau. Despite these assessments confirming water quality concerns, the waterways in Table 10 are still used by whanau (as shown in Figures 35-44).

[10] Sentiments expressed directly to whanau members – one by a Environment Canterbury staff member but more commonly by agricultural interests.
[11] Flow sensitive is defined in the Natural Resources Regional Plan as "a catchment that is vulnerable to reductions in summer low flows as a result of a change in the vegetation cover from short to tall vegetation.

Table 10: Environment Canterbury monitoring at swimming sites across Canterbury[12].

Catchment	Location	Result
Otaio River	Otaio Gorge	Fair
Opihi River	Saleyards Bridge	Fair
	Temuka River	Fair
	SH 1	Good
	Waipopo Huts	Fair
	Te Moana Gorge	Fair
	Waihi Gorge	Fair
	Lake Opuha – Dam boat ramp	Very good
	Lake Opuha – recreation reserve	Fair
	Lake Opuha – Ewarts Corner	Poor
Orari River	Gorge	Good

More recently Ngai Tahu have been denied access to kai due to increased gathering pressure by ethnic groups who either do not know or respect the tikanga and/or rules that regulate gathering.

In summary the sites still used by whanau are coming under increasing pressure - two types of pressure are being experienced:

- pressure on the use and development of aquatic waterbodies; and
- pressure on the aquatic species themselves.

In South Canterbury this pressure has led to conflict over the extent and impact of resource depletion and degradation.

As whanau explain:

> *Around the Waipopo area, from the Opihi River up, to Pleasant Point we would use the river for eeling, kanakana, floundering, yellow eyed mullet, herring. Around the mouth we would fish for kahawai.*
>
> *Around the Orari mouth we would use it for whitebaiting.*
>
> *Temuka, Opihi area is what we used for eeling. Right the way out to Winchester.*
>
> *Waitarakao was the name of Washdyke Lagoon…. My sister, me and her used to travel around there around gather flounders which used to be in the rocks. We used to gather karengo at certain times of the year on the rocks there. There were also eels taken there and whitebait … Kanakana was a favourite there and it's still there even though the*

[12] Environment Canterbury web page www.Environment Canterbury.govt.nz, downloaded 15 April 2008.

industrial area of Timaru has dumped a lot of its stuff into that area and it's considered polluted. So we don't go there as much now.

6.1.5 Preferred kai species

The principal foods from the Arowhenua archival data were from the main nutritional groups. As Williams (2004) explains:

- Kauru is a carbohydrate (and historically was gathered from 24% of sites).
- Eels are primarily a source of fats, but also sources of protein (gathered from 71% of sites).
- Mata/inaka, waterfowl and the Galaxiids are predominantly protein.
- Forest birds, kiore, kiwi and weka, combine protein and fat.
- Pora was a green vegetable.
- Aruhe was largely a "filler", eaten for bulk, and of low prestige; as was koareare.

Historically whanau and hapu consumed eels and titi as their main sources of fats. These were available in their greatest quantities in late autumn and early winter. Kanakana were a subsidiary source of fat. However South Canterbury was renowned for its kauru. As the main source of carbohydrate, great quantities of kauru were prepared. There is no record that kauru was preserved for consumption at a later date (Williams 2004), although McCallum (2007) describes how it was processed. Tikao describes the confectionaries made from kauru including fruit juices used as flavourings, and a type of jelly made with agar.

In contrast, the data from the Kai Consumption Questionnaire identified the contemporary preferences. Surprisingly, the top 6 according to the ratings (in order of preference) were:

1. snapper, koura.
2. kina.
3. trout.
4. pupu, pipi, cockles, herrings, oysters.

Eels which had been sourced from 71% of sites historically rated only 15th as the preferred food. However this is likely to be a reflection of how difficult they are catch because of their scarcity.

6.1.6 Seasonality of kai gathering

The following figures prepared by Anderson (1983) and Dacker (1990) illustrate the historical seasonal food gathering patterns for the southern region. Although some whanau adhere to these seasonal regimes, the technology (in particular the gear) available to fishers means that resources can be gathered all year round.

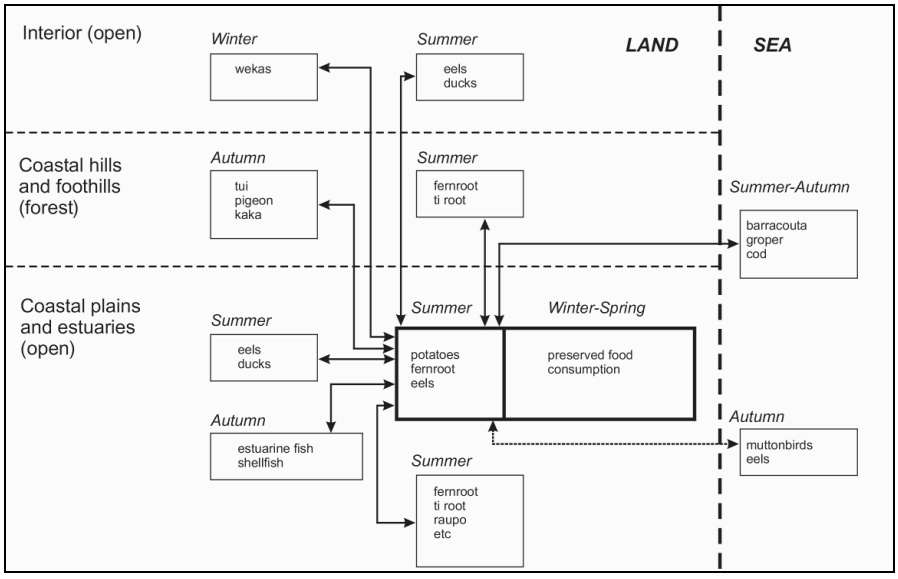


Figure 73: Seasonal Patterns of gathering (extracted from Anderson (1983:43, 1995:117)).

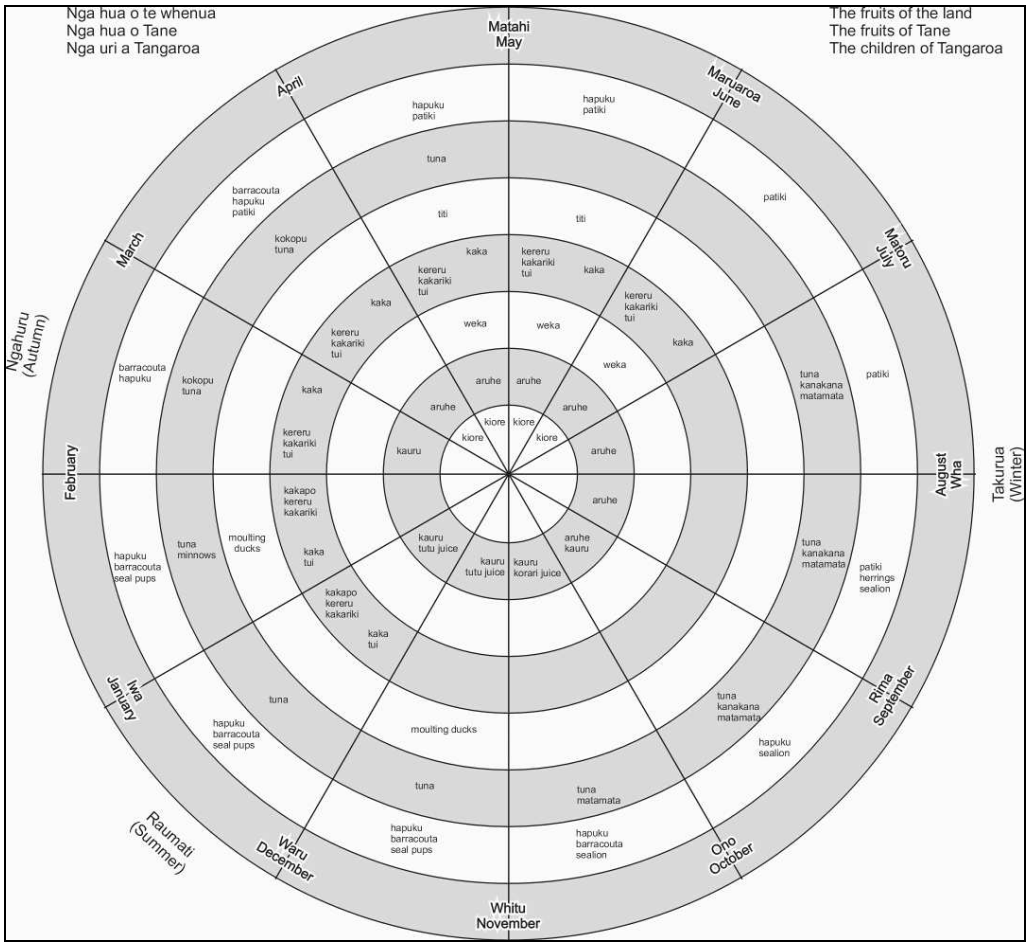


Figure 74: Seasonal Patterns of gathering (extracted from Dacker (1990:10-11).

The following Table has been compiled with the data from the Kai Consumption Survey identifies the seasons when species are gathered today.

Table 11: Seasonal kai gathering patterns today.

Species	Summer	Autumn	Winter	Spring
Herrings	■			■
Lamprey	■	■	■	■
Eel	■	■	■	■
Flounder	■	■	■	■
Paua	■	■	■	■
Mussels	■	■	■	■
Mullet	■			■
Kahawai	■	■		■
Moki	■			■
Shark	■			■
Whitebait				■
Trout	■	■		■
Kina	■	■		■

Key:

■ All the seasons when gathering occurs

■ When the most gathering occurs

Whanau commented -

> *It was all year round because the kai gathered from awa and moana were not supplementary but were essential.*
>
> *Eel have become lesser quantity and hard to get. We believe it's from commercial fisherman and they [eels] are smaller.*
>
> *About twice a year for eels and it really just to see what's there, its information gathering, because I just want to see if it's come back or if its better or if size of eels increased. I went out twice last year and you wouldn't spear as it wasn't big enough and it would be criminal to take. We just had a look around above lagoon to Railway Bridge in a night and it was a sad state of affairs. We hope things will get better.*
>
> *Kanakana is a little different as they are on a migratory thing as they in to breed in the mountains and they don't muck around. Between here and Railway Bridge (Opihi) it's a nights travel so if they come through early in night they will get to the Opihi Bridge and if they come in later then that's where I get them down here and stay in that ground so that why we go out at that time. Same thing at Washdyke they travel that quickly so anything in that line it only has come in that night so hopefully it's not polluted when we gather. Kanakana again it's sad it's hard to get and if you do get one it's a treasured source of food but more than that it good to see they are still there.*
>
> *Watercress is seasonal is usually goes with the frost but there are some spots under the willows.*

6.1.7 Processing of these preferred species

The processing of kai species also needs to be understood if all possible pathways of contaminants are to be identified. In this section only two species are discussed and the means of processing described.

1. Eels were often preserved as pawhera eels. The skin, backbones, heads and tails were removed and the eels hung out to dry. Curing them like this preserves them for months. For eating, they are softened by steaming. This process is called "pawhera". After this the eels are partly cooked and again dried. Flesh treated in this way could be stored for three years.

2. Titi (mutton birds) have long been an important food for Ngai Tahu, especially southern Maori who have control of the birding rights. Titi is a prized food. Once the chicks are collected, they are plucked and then the feet and wings are cut off. They are then dipped in wax to help remove the layer of down on the bird's body. Once hardened, the wax is cracked and removed, taking the down with it.

- "Poha titi" refers to the process of preserving the birds, whereby the hot fat retained from cooking the birds is poured into a kelp bag or kete and allowed to set, the flesh of the birds inside the pōhā is preserved for a very long time.
- Another method of processing is for the birds to be packed in salt and placed in buckets for shipping to whanau or to markets on the mainland.

Whanau also explained -

River and creeks used in that for rotten corn as well as fermenting spuds. We used to put them in there and brought them out and the smell was very strong.

They [tuna] were the main staple of our diet. Getting eel to supplement the table….. putting them in the deep freezer for the winter.

Anyway bring home tuna and clean it up myself.… I smoke some of mine and some I boil up in pot with watercress. The Maori boys showed me how to cook eels with watercress.

6.1.8 Perceived changes in the abundance of species that are gathered

A number of questions on the kai consumption survey sought to determine of the reasons for the dietary changes. The quantitative data summarised in Table 7 suggest the declining abundance of aquatic species in rivers is one of the main causes of diet change. However interviewees also reported degradation of aquatic environments, loss of access as a result of land tenure change, societal change (more specifically working longer hours) and government regulation as barriers to their engagement in mahinga kai activities.

Whanau were able to identify changes to different species -

A species that disappeared from when we were younger is koura. You would be lucky to see one. When we were young we would play in the creeks right down to the pa and we would take them home in jars. We can blame it on pollution in the Temuka River and they don't like that.

Amount of white baiters and the river systems have altered and the breeding ground along the side where they traditionally laid there eggs is just not there anymore and that's major reason.

Farming has changed this with drains being cleared out and the native grasses on edges are gone from banks and all you have now is a stream running through shingle.

For eel to gather half a dozen in half an hour and same with mussels back then. 10 mins on a reef there you would get enough.

When I went out early this year to get eel we went out at 8 pm to 2 in morning we only got 5 eels. Before you would have got that in 1 hour. Had to travel quite a bit to find them and the river has changed a lot since back then with a lot less water and there used to be a lot of holes where you could fish from but now you don't see that.

Loss of the numbers of eel and it's from commercial eeling because we used to find a lot of nets down river and we used to cut them up and let them go. And they got cunning and we can't find them now.

We don't seem to get the bigger eels. Four inches around anymore with them being a lot smaller now. Six of them used to be enough but with the size now you probably need 12 of them to get a decent feed.

6.1.9 Kai gathering – its contribution to wellbeing

The concept of mahinga kai extends beyond the nutritional value of species and its physical health benefits to encompass a range of cultural values. It describes species available locally and encompasses the cultural values attributed by whanau and hapu to these species as each is gathered, processed and distributed according to tikanga and kawa. Some of these values are discussed, albeit briefly, in the paragraphs below.

Whakapapa - Whakapapa is an important conceptualisation for Maori. Whakapapa is also central to kai gathering, which like many other cultural activities, is built around collective action (Ireson 1992, 1996). This is highlighted in South Canterbury where rights of manawhenua determine access to reserves and fishing easements.

Whanaungatanga - Kai gathering afforded opportunities for whanaungatanga bringing whanau together and enabling values and information to be transmitted from one generation to the next. A central tenet of whanaungatanga is to care for kaumatua and those unable to gather for themselves. After kai is gathered it is eaten together in groups of family and friends. It is therefore apparent that social capital built up through kai gathering could be more beneficial than those derived from more cotemporary individualistic activities, such as pataka. The development of these initiatives appears to draw upon these notions of social capital for cultural legitimacy.

Wairuatanga - Ngai Tahu and other Maori use different ways to feel spiritually connected with their takiwa. Gathering kai with whanau at a traditional fishing place, that they know was named by their tupuna and utilised by successive generations of their whanau, is one way. Being able to contribute the kai that their takiwa is renowned for, to ceremonies like kai-hau-kai[13] and to manaaki manuhiri can also bring that connection.

[13] Kaihaukai (Williams 2004) suggests breaking down the word kaihaukai into its component parts - *kai* (food); *hau* (obligation outstanding); kaihau ("Acquire property without payment or return made"

Manaakitanga - Although Durie (2004) contends that mauriora is dependent upon a secure cultural identity, diet changes can lead to loss of culture and identity. Having the ability to manaaki visitors by supplying kai sourced from one's takiwa means that the activities of fishing, eeling and gathering other foods creates and maintains community ties and reinforces identity. Conversely the inability to manaaki guests and sustain whanaungatanga can lead to cultural loss.

Matauranga Maori - As has been previously stated, the activities of gathering and preparing kai serves the functions of passing on traditional knowledge from one generation to the next. Matauranga Maori is developed and transmitted through practices of food management, harvesting and preparation. A great deal of knowledge is needed in order to obtain kai - knowledge of techniques and also knowledge of ecosystems. If populations of aquatic species do not return, knowledge of the techniques of gathering these foods along with the associated ecological and cultural knowledge and the process of gathering will likely also begin to disappear. Knowledge of preparation is also important. Yet as food species disappear from the dining table, the particular knowledge of how prepare foods is also lost.

Te Reo - That kai is instrumental to a culture is reflected in the stories and Te Reo that pertain to food. Te Reo contains knowledge and is an expression of culture and identity. Te Reo has been declining for many reasons, one of which may be attributed, in part, to changing lifestyles. When a valued species disappears from a local ecosystem, or the activities associated with a species decrease, the associated Te Reo drops out of usage. When 92% of the respondents confirmed that they would stop gathering if advised that species and sites were contaminated, the indirect cultural impacts that would ensue could represent a significant loss.

Cultural survival - This section has attempted to describe how kai gathering is the glue that binds whanau, hapu and community together, providing a sense of identity that also serves as the vehicle for the transmission of values and knowledge. Mahinga kai probably received more recent attention than any other tribal issue in the Ngai Tahu claim. Archived documents, including evidence previously cited in this report, provides in-depth testimony concerning the cultural and spiritual significance of aquatic kai species and of the water bodies across South Canterbury themselves. If contaminants lead to a further reduction in kai gathering, which is arguably at the heart of Ngai Tahu culture, at stake is nothing less than Ngai Tahu cultural survival.

Williams (1983:87)). Therefore kaihaukai, describes a feast which obligates those who received the feast to reciprocate. Williams (2004) explains that the kaihaukai was rather more complicated than as it was a form of trading, as there was a distribution of surplus food.

Hauora Maori - The presence of kaumatua represents "intellectual capital". They are holders of a wealth of critical information about the past and can draw on this knowledge to provide accurate assessments of environmental condition, including changes over time, at a localised level. The results from the Kai Consumption Survey confirm that differences in behaviours, perceptions and knowledge are found with the different generations. Loss of relationships with the natural world could lead to grief. Many feel whakama when unable to fulfil the social roles expected of their age groups. At stake with the loss of kai gathering is not only cultural survival, but potentially the physical and mental wellbeing of whanau members. The comments of whanau members support the statements above.

> *We learnt that from our mother and she learnt off her grandmother and we have passed it on.*
>
> *Anywhere we were taught to get kai was from mother and this became less and less as she had a great knowledge of what was safe in her head and what wasn't and we follow this.*
>
> *Kai is shared with whanau and extended whanau. If you have anymore than you need you would share. It's such a rarity to get kanakana that you first think of giving it to your elders. This has always been our way with giving away your first lot.*
>
> *Tuna was our staple. Temuka was renowned for tuna… Today there is nothing there in comparison. In those days the quantity there was more than enough and to share with visitors and today we have barely enough for ourselves let along share with our visitors which isn't good.*
>
> *…mainly taught by grandmother and grandfather they show you want to do.*
>
> *Always part of life we were brought up with it. I would love to give the same amount of attention to these areas and have them for my children when they grow up but with the lack of places to do what we want to do like eeling and catching kanakana the environment is not there. Then the whole process of teaching your children the same knowledge from parents and grandparents disappears as well. The whole community feeling of Maoridom goes as well.*
>
> *My children are in Christchurch and they would love to learn and I would love to teach them and they are getting less chance to learn. There is a lot of whanau around us and the younger generations are moving away from the marae and they are not coming back to the rivers and moana to get the food which we gathered with supermarkets being cheaper for them.*
>
> *It mainly for table.… I don't just go and get it for the sake of getting it. I would rather have it fresh.*

We always share what we get with family or with visitors from Christchurch and we would give them some to take away. Always been like that.

First to the kaumatua. That is a practice always it still down now. Even now with watercress and that's done regularly.

We had areas where we went to gather kai and you would see others (whanau). I am one of the only few kaumatua who gather kai. Though some kaumatua may get kai given to them from there whanau. Those practices still going on with some times I walk out and I see a bucket of cockles. This year alone I have had ducks, Canadian goose, cockles and paua.

The difference between now and then there was a need to put kai on the table because it was traditional it didn't matter how far you went. Sometimes it was on a horse and cart and it became a whole day thing. You all went out and gathered. … But that is all gone now. There is not a need now. But we need to exercise our customary rights. There is a perception out there that the river belongs to the trout. One of the main things when talking to Fish and Game. In the past there were eel drives where they would put them up on the banks and let them rot. This was to protect the trout.….

6.1.10 Perception of the environment

Questions sought information from interviewees about how they perceived:

- the abundance of kai species;
- the condition of sites from which kai is sourced;
- the changes to their gathering behaviours; and
- barriers to gathering.

The results in relation to the first three dot points have been discussed in the previous paragraphs. With respect to the perceived barriers, the results show that opinions varied. The results are collated and listed below, and complemented by the quotes of interviewees where appropriate.

Government and council actions acting as barriers

- Need for authorisation, permits and licenses before gathering – that restricts quantities to be gathered and the seasons of gathering.

- Introduction of the Quota Management System (QMS) for highly valued species (e.g., eels) and as a result commercial over-harvesting threatens populations.

- Mismanagement of waters, lands and resources by regional and district councils.

- Lack of any management input by Maori over lands, waters and resources.

- Lack of support to undertake stock assessments of valued species and if necessary implement restorative programmes.

- Redefinition of the customary right to a "non-commercial" right thus preventing restoration of bartering and trade.

Mahinga kai gathering is no longer able to be undertaken according to tikanga. Over time the cumulative effect of settlement and government regulation changed both the circumstances and practice of kai gathering, with both the river environments and the fisheries impacted. Many whanau no longer live in the catchment, kai is not their livelihood, and kai no longer their staple diet. Regulation tries to dictate what they gather, where they gather, and when they gather. But this knowledge – what, how and when - is the basis of matauranga – the knowledge that Ngai Tahu are supposed to possess. In other words the changing face of mahinga kai as a result of regulation also led to the practices, decision-making and knowledge generating processes associated with mahinga kai being changed or alienated from many Ngai Tahu resource users.

Environmental problems acting as barriers - South Canterbury has been heavily impacted by agricultural development and to a lesser extent urban and industrial development. Informants voiced their concerns at environmental conditions which they argued kept them from gathering kai:

- Sewage/contaminants from septic tanks, town sewerage schemes.

- Scarcity/limited availability of resources.

- Over-harvesting of resources.

- Intensification of agricultural land uses.

- Run off from farmland, especially from dairy farms.

- Discharges from industry e.g., scours mills, freezing works.

Land tenure change - Without doubt land loss alienated many whanau and hapu from mahinga kai gathering:

- Private land – many of the lands across South Canterbury were taken up by settlers by the late 1860s.
- Inability to gather on DOC lands.
- Recreational hunters/fishers gaining prominence.
- QMS instituting a property rights regime.
- Locked gates on private property limits access.

The most densely settled areas in South Canterbury are along the coastal margin while the river valleys that are ecologically productive and previously supported intensive mahinga kai usage, now sustain intensive agriculture.

Lack of Traditional Knowledge creating barriers - The practice of mahinga kai represents generations of learning and teachings about places, the resources they yield and the methods of gathering and processing resources. Internationally there are ongoing discussions about the loss or erosion of traditional knowledge as indigenous communities become more integrated into regional or national economies (Inglis 1993, Berkes 1994). It is recognized, however, that it is important to differentiate, between situations where matauranga held by hapu and whanau is adapting to new environments and economic conditions and where matauranga is being lost due to a disruption of its transmission.

But to understand ecological knowledge one must participate in the processes of hunting, fishing, gathering and processing of kai. In other words whanau with a history of use and those who continue to use waterways and resources are those that retain and continue to generate the matauranga. In this way, directly or indirectly, the whanau is the main perpetuator of the Ngai Tahu way of life and stories.

The data sourced from rangatahi suggest that they are experiencing the consequences of the loss of knowledge generation processes, while the comments of pakeke suggest they are losing the opportunities to teach. It is encouraging, however, that not all this knowledge is lost and given the opportunity, would be able to flourish in a re-invigorated cultural context.

As whanau explained –

Watercress you have to go upriver to get decent looking watercress because below the bridge you still got that backwater coming back it must build up and still come back and you can taste it. But up river the waters still flowing through and even the trout still taste better than below the bridge.

I go to the Orari if I want to catch some flounders as the river is free flowing.

Mouth open running straight should be….. It should be straight out so it can come in and then out to clean it out.

I have taken an eel from a good drain toward Clandeboye. It was a old haunt there. But I didn't eat it as it smelt of cow dung and I never went there again.

The things destroying the river are 4wd and motorbikes. They think it's a big deal to drive up the riverbed but they don't know what they are destroying.

They have put the price of rubbish dump up and what people are doing now are they are dumping along the riverbank now. It's a council issue.

I believe there are health risks because of practices over the years like the wool scour. We don't know what chemicals are going in and what that is doing to the watercress and the tuna. The other one that worried me were the timber mills around the area and I am always suspicious of the chemical they are using.

6.1.11 Health and wellbeing of whanau members – the mixed methods and contradictions

Toxic contamination and the resultant health impact on humans has received considerable research attention over the past three decades (Edelstein, 1988; Freudenberg, 1984; Perrow, 1984). This research seeks to explore the potential health consequences of the changing kai gathering behaviours sourced by whanau and hapu in order to determine the ongoing risk of exposure to contaminants.

Ngai Tahu continue to be dependent upon kai gathering both physically and culturally. Mahinga kai was the primary food source and the basis of an economy based on trade, barter and exchange. The transition from wild sourced kai which in the case of South Canterbury numbered more than 30 species to a western style of diet comprising commodity/convenience foods consequently impacted Ngai Tahu socially, culturally, economically and spiritually.

Physical health - Physical health is directly linked to the quantity and quality of food consumed, as well as the cultural, social and economic conditions within which individuals live. In the context of this research programme, physical health consequences arise from four factors:

1. changes in the nutritional value of foods consumed today compared to their traditional diet;
2. being denied access to gather also affects health by limiting the physical exercise associated with the act of gathering;
3. the risk of contamination of kai that is consumed;
4. the risk of contamination from the sites that kai is gathered from.

The loss of access and use of traditional resources is now recognised as being a contributor to a change to a western style of diet and the consequent rise in diet related illnesses which from an economic perspective could cost society. However the converse is also of concern as for those whanau who still gather kai there is a risk of exposure to contaminants from eating wild sourced kai.

An important health benefit of kai gathering results from the act of gathering itself – an activity that requires physical activity. The importance of exercise to general physical health is widely recognised. Traditionally Maori got a lot of exercise in the course of gathering kai. Although the amount of exercise that whanau get now as a result of gathering has declined, those surveyed reported engaging in some activity, although the frequency of such activity has declined as gathering behaviours have changed. However, it cannot be assumed that all gathering will be beneficial as the physical act of gathering resources could expose whanau to health risks as the sites where gathering occurs, specifically the waters and sediments, could be contaminated. The levels of contaminants in kai gathered and the environments in which they are found, will be reported separately. In addition, models describing possible risk to tangata whenua will be developed as part of the risk assessment and communication component of this project.

Wellbeing - The benefits derived from being in natural settings are also gaining increased recognition (Kaplan & Kaplan 1977, 1982). In addition to the data on diseases within the family (using data obtained from the Kai Consumption Survey), the interviewees described the broader social, economic and cultural impacts resulting from the changing patterns of kai gathering and consumption on their wellbeing – as individuals, as whanau and as a collective. The comments of informants describe the contribution of gathering and eating kai on wellbeing.

6.2 Implications for future management

The results of the Kai Consumption Survey show that the gathering and consumption of kai awa, kai roto and kai moana is highly complex. This is in terms of both the differences in availability of kai awa, kai roto and kai moana between hapu, the diversity of aquatic habitats, and the diversity within and between whanau. There is some indication that consumption levels are also related to the quality of kai awa, kai roto and kai moana that is available and the quality of aquatic ecosystems that they come into contact with when gathering. These results enable us to make a number of observations with respect to future management.

Sites from which kai is gathered - Where and when people gather kai is a function of the location of their work, the proximity of waterbodies, and other activities of a whanau. This is supported by Garaway (2005) who argues in relation to fishing that it is almost always combined with other activities. The Kai Consumption Survey confirmed that whanau are likely to go fishing in a nearby lake or stream thus reducing the time spent travelling between areas of work, home and collecting. For Ngai Tahu this means gathering from the lowland reaches of streams that are some of the most degraded in Canterbury. While many of the scenically attractive braided rivers of Canterbury attract attention from environmental organisations seeking their protection, it will be interesting to see who in the community, aside from Te Runanga o Arowhenua, will put their hand up to protect the many small waterbodies that support kai gathering.

Preferred kai species consumed - Knowing the preferences of whanau is essential if restoration initiatives are to target the priorities of whanau and hapu. If resources available for such initiatives continue to be limited, targeting funds to priorities is inevitable. A related concern that emerges when whanau do identify their preferences is that there are very few surveys undertaken to determine a "population baseline". Without this information it is difficult to determine what a sustainable level of customary harvest is.

Perceived changes in the abundance of species - If Maori are interacting with aquatic ecosystems on a regular basis they are ideally placed to observe changes – to sites and to species. Guidance is needed to ensure that their observations are part of a structured and robustly designed perception study so that they are not to have their observations dismissed as being "anecdotal". However, the challenge will be that few agencies support perception based assessments – let alone prove that a species is at risk and in need of management intervention.

Kai gathering behaviours - There is a complex mosaic of uses and users of aquatic resources within a takiwa that collectively shape the livelihoods of whanau and hapu. Kai gathering cannot be classified as one activity. Instead, they are part of a complex combination of activities for a range of members in a household. As the survey shows whanau hunt, and tend fruit and vegetable gardens. The effort afforded to gather kai is not a homogenous activity – it is a flexible activity that is undertaken by different people, at different times, targeting different species from different waterbodies using a range of equipment. Collectively this confirms a complex relationship between humans and their environment. It is important that information continues to be collected to increase our understanding of these range of behaviours, including their aspirations.

Disseminating advice about contamination issues - Furgal (1999) and Grondin and Carron (1999) argue that we need to consider both formal and informal networks when it comes to the circulation of information. Data from the Kai Consumption Survey confirms the need for formal and informal networks and suggests that advice could be provided by Health Protection Officers and Environmental Protection Officers, Maori Health Workers and whanau members.

While Maori have been active in developing relationships with resource management agencies, formalised relationships with the parties that can undertake the research necessary to understand contamination issues and deliver the messages, may need to be developed**.**

7. The next steps in the research process

Maori are faced with a "Catch-22" – whanau and hapu want to continue to undertake cultural activities, such as kai gathering, that they contend are central to "who they are". However because of the risk of exposure to contaminants, these same cultural activities could be the cause (and not the cure) of some of the ills being experienced by whanau and hapu.

This report has shown how looking beyond simple representations, such as consumption, reveals the complex and diverse role of both kai awa, kai roto and kai moana in the behaviours of whanau and hapu. Further, kai awa, kai roto and kai moana are accessed in diverse and complex ways.

The results from the Kaimoana Consumption Survey clearly support the statements found in archival records, and as articulated to the Waitangi Tribunal in 1989-1990 that kai awa, kai roto and kai moana are vitally important to whanau and hapu in South Canterbury. It appears that, consistent with the cultural values of whanaungatanga and manaakitanga, there is significant distribution of kai outside of whanau. For hapu, kai awa, kai roto and kai moana continues to represent a food source upon which all members of a hapu can subsist if the health and abundance of species and the condition of valued sites are assured.

Kai awa, kai roto and kai moana are also represented in terms of their wider social and cultural importance. Being able to maanaki visitors and provide kai sourced from your takiwa remains of fundamental importance. Other forms of provision, such as purchasing kai and / or having it supplied through systems such as pataka, have drawn on the social and cultural values associated with gathering kai awa, kai roto and kai moana to be legitimised within both Maori and government institutional planning. Arguably the outcome is that kai awa, kai roto and kai moana threatens to be reduced to 'availability' and species is increasingly becoming synonymous with supply from commercial fishers rather than customary gathering.

7.1 Next steps

Using the site specific data and the species data that resulted from the Kai Consumption Survey, the next stage of the research will identify the types and levels of contaminants present in the "wild kai" and associated habitats identified by Maori.

The analyses that are proposed at the next stage will then enable the researchers to establish potential pathways of contaminant bioaccumulation via the food web. This information will then be available to whanau from Te Runanga o Arowhenua.

7.2 Disseminating advice about contamination issues

> *Communicating the risks of environmental contaminants in the food chain to northern Aboriginal peoples poses significant challenges for communities at risk and environment and health professionals alike..… communication practice on this issue include increased fear and confusion in northern communities, changes in the dietary behaviour and traditional lifestyles of their residents, and associated impacts on their society, economy, and health. … The importance of this information is increasing as research begins to detect subtle health effects from exposure to these substances among newborns in some northern regions. Thus planning and evaluation are needed for risk communication, and possibly changes to the scale at which communication work is done in northern communities.* Furgal et al., (2004).

Frugal (2003a) contends that some of the challenges associated with communicating contamination risks are unique to the specific issue and the context of communities. This chapter has repeatedly stressed the contradictions or the Catch 22 that Ngai Tahu find themselves as a result of trying to balance two potentially conflicting perspectives:

1. the health and wellbeing benefits that results from the continuing practice of gathering kai or conversely the impacts that arise when changing from a traditional lifestyle and diet; and
2. the adverse impacts on health and wellbeing arising from contamination of aquatic ecosystems and the potentially the kai species themselves.

The cultural comprehension of what is “risky” behaviour is complex. Maori, like those in other indigenous communities, have limited experience with food safety issues similar to that of contaminants in foods they gather.

Understanding how indigenous communities perceive contaminants, has significant impacts on the reception and effect of messages delivered. Usher et al., (1995) contend that communities may distrust the information they receive about contaminants in foods and their distrust could affect their reception of further explanations or clarifications. Furgal et al., (2003a) found that concerns over contaminants was not a determinant of food choice in one Labrador community, yet Kuhnlein et al., (2003) reported that 42% of women interviewed in five western Arctic communities indicated “concern over contaminants” as a reason why they did not serve more foods to their families. The objective of this research is to effectively

convey to Maori the risk of gathering kai. Overseas research indicates a number of aspects need to be addressed.

The advice to be delivered - A minimal amount of work has been undertaken to identify the types of messages that elicit certain or desired responses. Usher et al., (1995) indicates that good messages are direct, simple, not condescending, put in a personal context, accurate, translated into local languages, delivered early and often, and build upon local understandings and knowledge of the issue.

Materials to be presented - Numerous forms of materials have been used to communicate messages on contaminants and country food in North America including posters, fact sheets, reports, pamphlets, personal letters, radio public service announcements, radio call-in shows, regional video programs, door-to-door or face-to face communication, community meetings, school curriculum materials, and national live television broadcasts (Furgal et al., 2003b). From the Kai Consumption Survey we know that a range of media are likely to be needed.

Delivering the advice - To be effective a message has to be distributed through pathways that ensure it will reach and engage the target audience - in this instance, hapu members who gather kai. Furgal (1999) and Grondin and Carron (1999), in their work with northern hemisphere communities, identified the need to consider both formal and informal pathways of delivery and information circulation. Data from the Kai Consumption Survey confirms the need for formal and informal networks and suggests that advice could be provided by:

Formal networks:	Health Protection Officers and Environmental Protection Officers
	Maori Health Workers.
Informal networks	Whanau members

Specificity - Vaughan (1995) and Slovic (2000) contend that personal experience, gender, age, socioeconomic status, and profession influence perceptions of risk. Understanding how Ngai Tahu see the issue is critical to ensure that the communication is best oriented towards their understandings and perspectives.

McGrath (2003) argues for a relationship based approach to exchanging knowledge on issues such as contaminants within and between communities. This will require scientists and communicators to understand the informal paths of information flow in communities so they can develop mechanisms that support and utilise these pathways to communicate information about contaminants.

> *One might argue that little true "communication" on the issues of contaminants, food, and health has taken place between scientists, health professionals, and Aboriginal residents in many northern communities; rather, a great deal of scientific information has simply been disseminated* Leiss (1997:29).

Understanding and developing ways to better communicate information on contaminants and their impacts on health is critical. Reports of contamination can undermine confidence of whanau in their environment and gathering of resources as a source of individual and collective well-being.

As whanau explain -

> *All we have is speculative information about kai. If we had scientific information about what's in our kai and the area of where we are gathering kai if it could dangerous then we would make decisions about that.*
>
> *As long as area is clean then it's no problem. Going back to the lagoon it's a big risk to eat from there. I don't know anyone being sick from it. But it would be silly to eat anything from there because you can see the water before you get there.*
>
> *I wish they would do something about the river here. It's getting worse every year. Since the dam has been up we have never had a real flood to clean out river. We have just had a lot of rain and you should smell the lagoon now it smells nice and fresh. It washed the river through. You need that fresh water to clean the river. I may go down to the Opihi this year since there has been a fresh going through it.*

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Tribunal Evidence

J:10, H:1, H:10, H:47, H:49, F:11, P:15(a).

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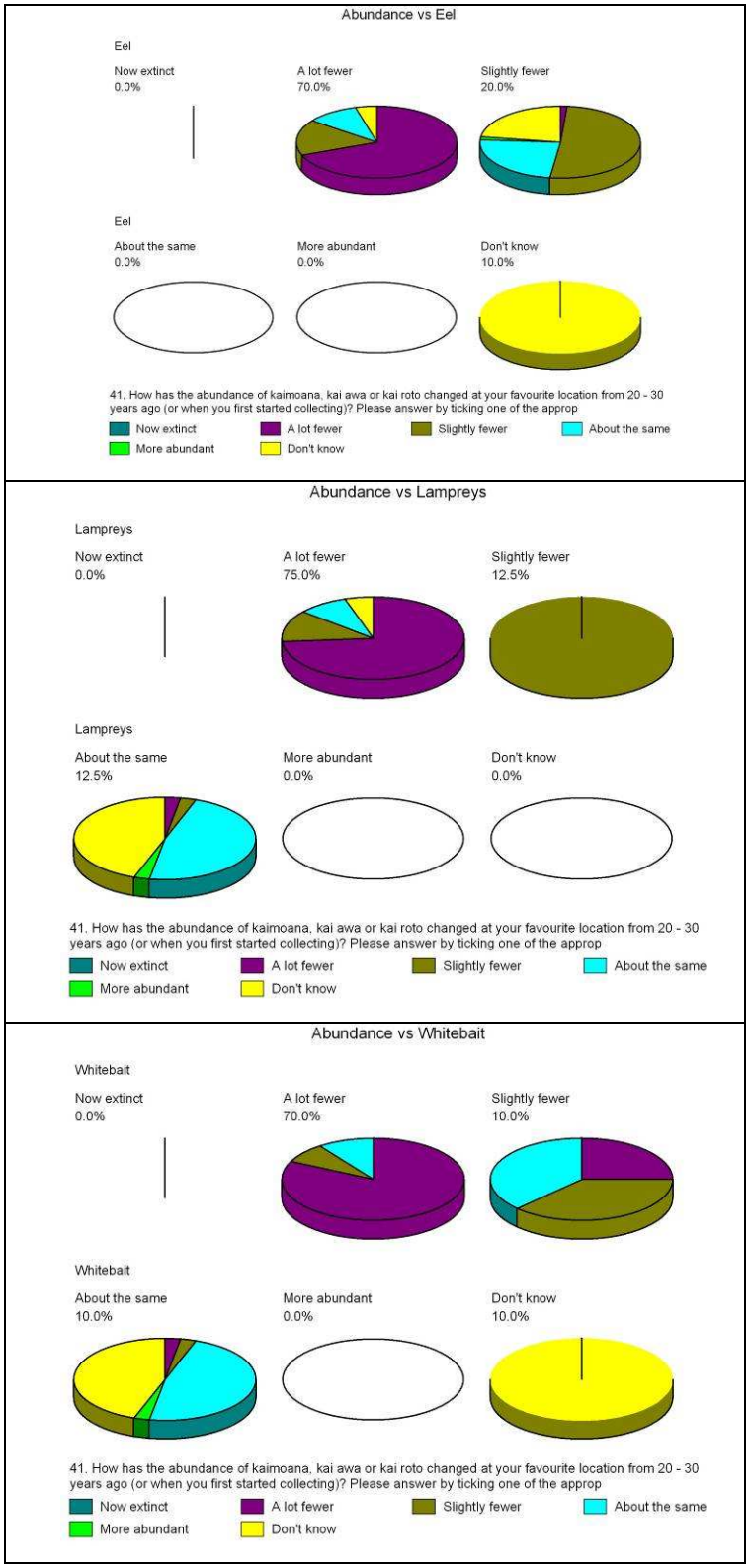
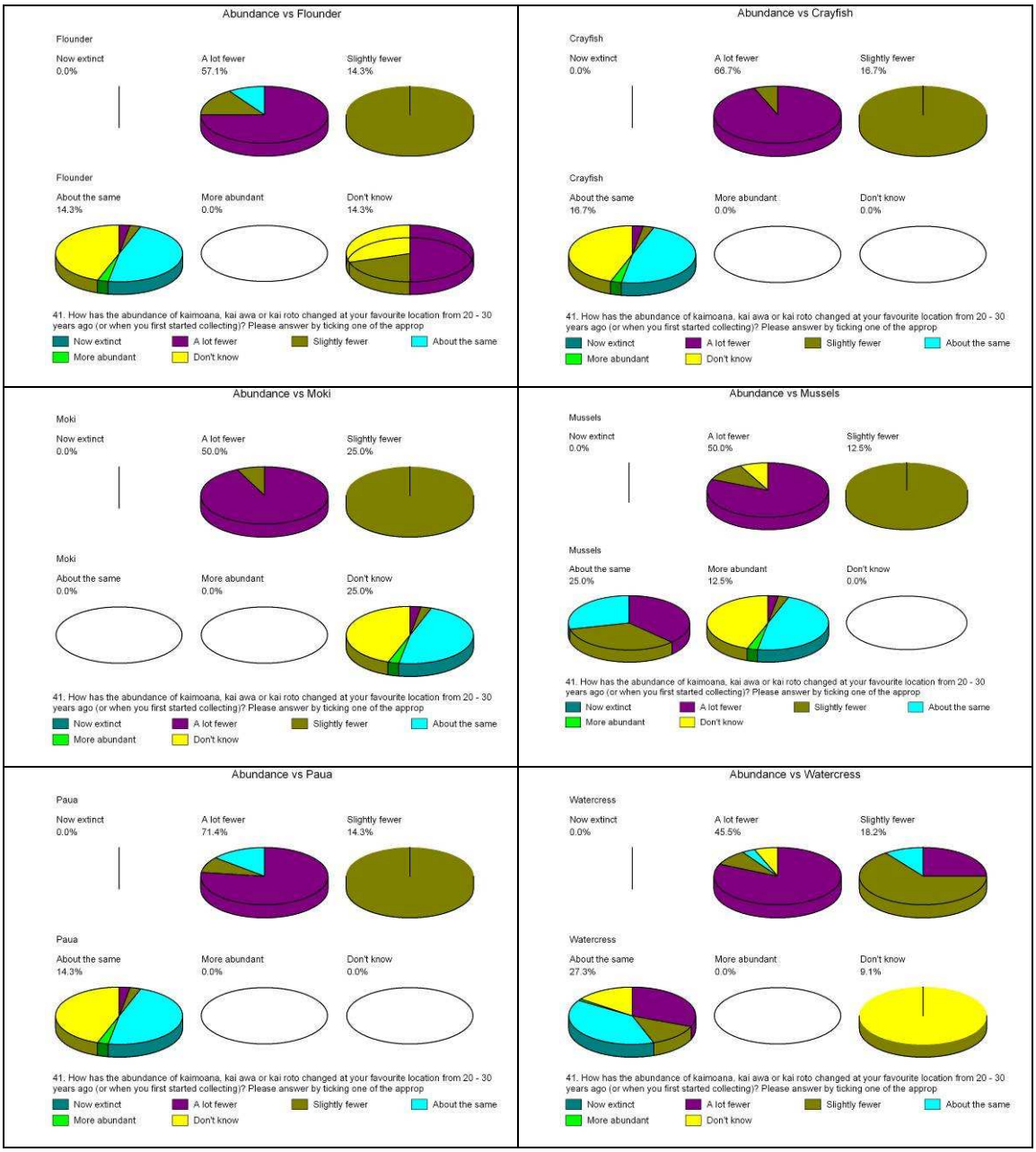
We wish to thank the tangata whenua of Te Runanga o Arowhenua for the opportunity to undertake this mahi with them. We also acknowledge the financial support on the New Zealand Health Research Council (HRC Ref: 07/240).

10. Appendix 1: Perceived changes in abundance of species




Abundance vs Flounder
Flounder
Now extinct 0.0%
A lot fewer 57.1%
Slightly fewer 14.3%
Flounder
About the same 14.3%
More abundant 0.0%
Don't know 14.3%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know
Abundance vs Crayfish
Crayfish
Now extinct 0.0%
A lot fewer 66.7%
Slightly fewer 16.7%
Crayfish
About the same 16.7%
More abundant 0.0%
Don't know 0.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know
Abundance vs Moki
Moki
Now extinct 0.0%
A lot fewer 50.0%
Slightly fewer 25.0%
Moki
About the same 0.0%
More abundant 0.0%
Don't know 25.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know
Abundance vs Mussels
Mussels
Now extinct 0.0%
A lot fewer 50.0%
Slightly fewer 12.5%
Mussels
About the same 25.0%
More abundant 12.5%
Don't know 0.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know
Abundance vs Paua
Paua
Now extinct 0.0%
A lot fewer 71.4%
Slightly fewer 14.3%
Paua
About the same 14.3%
More abundant 0.0%
Don't know 0.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know
Abundance vs Watercress
Watercress
Now extinct 0.0%
A lot fewer 45.5%
Slightly fewer 18.2%
Watercress
About the same 27.3%
More abundant 0.0%
Don't know 9.1%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

11. Appendix 2: Sites and species identified by iwi participants (number of respondents)

Kai	Opihi River upstream of SH bridge	Opihi River below SH bridge	Opihi River Mouth	Orari River Upstream of SH bridge	Orari River Mouth	Ohapi Creek	Temuka River	Waihi River	Te Hae Hae Te Moana	Jacks Point	Washdyke	Otaio River	TOTAL	Other
Watercress	6	7	3	3	4	2	5	3	2				**35**	Awarua (x3), Temuka, Te Umukaha
Eel	7	4	3	2	2	2	5	3	3	1	1	1	**34**	Te Umukaha
Trout	5	3	2	1	2	1	5	2	1	1	1	1	**25**	Te Umukaha
Whitebait	1	4	6		3		3				2		**19**	
Flounder	1	2	5	1	2		2			1	3		**17**	
Herrings		2	3	1	1					1	1		**9**	
Lampreys	1	1	1		1		2	1			1		**8**	Waihao
Mussels										5	1		**6**	Timaru (x2), Teaitaraki, Jacks Point, Moeraki
Kahawai			2		1					1			**4**	Teaitaraki
Mullet		1	1							1	1		**4**	Teaitaraki
Oysters										1	2	1	**4**	Patiti Point, Bluff
Shark			2							1			**3**	Moana
Puha							3						**3**	Temuka, Te Umukaha, Awarua (x2), all over
Paua										3			**3**	Teaitaraki, Jacks Point, Moeraki
Seaweed										1	1		**2**	Wales
Crayfish										1			**1**	Kaikoura, Teaitaraki (x2), Moeraki
Kina										1			**1**	Teaitaraki
Muttonbirds													**0**	Titi Island (x3), Papatea
Cockles													**0**	Warrington, Karetane
Freshwater mussels													**0**	Pareora (x2)
Tuatua													**0**	Teaitaraki
Freshwater crays													**0**	Pareora (x2)
Greenbone													**0**	Papatea, Bluff
Toheroa													**0**	Oreti
Pupu													**0**	Moeraki
Hapuka													**0**	Moana
Kingfish													**0**	Nelson
Snapper													**0**	North Island
Moki													**0**	Timaru
Tarakihi													**0**	Timaru
Trevally													**0**	Timaru

A survey of wild kai consumption in the Arowhenua rohe

NIWA Client Report: HAM2010-098
August 2010

NIWA Project: HRC08201

A survey of wild kai consumption in the Arowhenua rohe

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Contents

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Executive Summary

Waterbodies impacted by pollution and suffering environmental degradation represent a risk to the health of both aquatic organisms and humans. Even at low concentrations contaminants, particularly organic compounds, can cause long-term impacts and pose significant risks to the health of biota and humans. Human health may be threatened either by the consumption of food (especially fish and shellfish) contaminated with pollutants, or by direct exposure (via water and atmosphere during collection) to them (Boesch and Paul 2001). This research, funded by the New Zealand Health Research Council over a three year period, ultimately aims to improve Maori health by identifying, quantifying, and effectively communicating the risks associated with the collection and consumption of wild kai.

Wild kai, gathered from the sea, rivers, and lakes, has always been an integral component of Maori lifestyles, but today is increasingly susceptible to contamination. The impacts of environmental contamination in wild kai on Maori have not been investigated to date. The present research sought to address this shortcoming. As part of the first phase of the research, Maori from three communities were asked to identify species, locations and quantities of kai moana, kai roto and kai awa consumed. This was to enable the levels and types of contaminants in the kai to which Maori are exposed to be determined, and pathways of potential contaminant uptake by tangata whenua investigated by analyzing relevant food-chain components.

Three Maori communities were involved in this research: Te Arawa: centred around the Te Arawa / Rotorua Lakes and Maketu coastal area; Ngāti Hokopu ki Hokowhitu: centred around Whakatane; and Te Runanga o Arowhenua: centred on South Canterbury. The three communities differ in their access to and use of aquatic resources. Each community is characterised by different physical, natural, social and political capital which directly impacts on the level of kai awa, kai roto and kai moana gathered and consumed. In each region the diversity of aquatic ecosystems utilised, with spatial and temporal patterns of gathering unique to the each place and community, reflect a history of complex, locally specific tikanga and kawa driven behaviours. Exploring the complexity of this inter-community variation was beyond the scope of this research.

This report documents the results of the first phase of the above research programme, specifically investigating the level of kai consumed by members of Te Runanga o Arowhenua, whose whanau have resided in South Canterbury for centuries. For centuries the rivers, streams, wetlands, lakes and hapua have also been the mainstay of their economy providing freshwater fish, shellfish, waterfowl, and plants.

With respect to the research design drawing on the earlier work of Bebbington (1999), importance of kai to whanau was examined using standard interview techniques according to:

- the instrumental role – the significance of rivers, lakes and coastal environments as a source of physical health (specifically nourishment); and

- the hermeneutic role - the ways in which kai awa, kai roto and kai moana give meaning to the lives of whanau and hapu. Contemporary research seldom examines the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana, which when communicated to policy makers in the absence of empirical data, are often dismissed as anecdotal. Finally, kai awa, kai roto and kai moana (and the waterbodies from which they are sourced) are examined in terms of their cultural embeddedness of whanau and hapu.

All of those interviewed for this research expressed a strong relationship with the lakes the wider terrestrial and marine surroundings. Whakapapa, ancestral connection to the lakes area and ahi karoa remain significant elements of the relationship. Two thirds of the participants spent their childhood in South Canterbury (within the takiwa of Te Runanga o Arowhenua) while two of the participants grew up in the North Island.

A large variety of kai continues to be regularly collected, gifted, purchased and/or consumed. While whanau continue to gather a range of species, it is considerably less than the 38 species that we know from manuscripts were historically obtained from these sites across South Canterbury. Although some resources were gathered seasonally, historically whanau relied on freshwater resources year round. The principal purpose of the Kai Consumption Survey was to determine the extent of gathering by whanau living in the South Canterbury region. Consistent with a kai gathering lifestyle:

- 78.5% grew their own vegetables.

- Of the 78.5%, 57% of those who grew vegetables also grew fruit.

Having determined that all of respondents do consume different types of kai:

- 40% of respondents said they now only eat kai on special occasions; while

- 18.9% eat kai less than once a month; and

- 22.3% eat kai 1-3 times per month.

In other words 81.2% eat kai 1-3 times per month or less.

In addition to identifying the species gathered, the sites from which kai was sourced were identified. These sites were then used as the basis for a sampling programme which examined contaminants in sediment and kai. Kai was gathered from 13 waterbodies across the region. Approximately 47% of

participants gather from the Temuka River, while the Opihi River (upstream of State Highway 1, downstream of the State Highway, and the river mouth) is used by 30%, 28% and 37% respectively.

If kai moana, kai awa and kai roto are to be promoted as a beneficial source of food for whanau, there need to be sufficient quantities of healthy stocks in order to sustain gathering. Questions in the Kai Consumption Survey asked whanau to provide their assessment of the stocks of various species gathered. Of concern, 54% of respondents believed that across all species gathered there were now a "lot fewer" available while another 17.9% believed that abundance was "slightly fewer".

Whanau were asked to identify their preferred kai. Surprisingly, the top 6 preferences according to the ratings (in order of preference) were:

1. snapper, koura
2. kina
3. trout
4. pupu, pipi, cockles, herrings, oysters.

There is little data available to enable calculation of pre-European contact per capita consumption of kai. Even if it was possible to determine harvesting levels for particular species, it is difficult to calculate how much food (and what species) on top of this would have been received as a gift or obtained through trade. For the calculation we assumed that historically wild sourced kai would have been consumed on average once per day. From interviews we know that wild sourced kai was consumed "at least 3 times" per week in the 1970s and 1980s. Some whanau, however, eat kai daily. However a crucial time period – around the 1970s and 1980s – marks a significant change in the quantity of kai consumed as interviewees confirmed that more convenience foods started to appear in whanau diets. From the interviews this coincides with observable deteriorations in the health of aquatic habitats. Again to enable a calculation of kai consumption in the mid twentieth century we have assumed kai was consumed 3 times per week.

With respect to contemporary consumption, from the Kai Consumption Survey, all respondents still consume kai awa, kai roto, or kai moana. The quantities available fall far short of historic levels and the levels desired by whanau who wish to engage in mahinga kai practices, although they exceed average New Zealand consumption rates (32.87g per person per day).

Kai consumed historically	Equals 230.77 per person per day
Kai consumed up until 1970s &1980s	Equals 98.63g per person per day
Kai consumed today	Equals 43.81g per person per day

Part of the reduction in quantities consumed can be attributed to environmental degradation. A species will show signs of dwindling for a while and then suddenly decline because its population is no longer self-sustaining.

Major changes in mahinga kai gathering behaviours began some 160 years ago with European settlement. Newly introduced foods replaced wild sourced kai principally because of the relocation of whanau and hapu to reserves, their assimilation into mainstream New Zealand culture, and damage to the resource base resulting from use and development of resources by the newly arrived settlers. Interestingly many of the sites still utilised by whanau are found in close proximity to reserves and easements.

Although the initial loss of land occurred in the mid eighteenth century the interviews with whanau members (especially kaumatua) confirmed that they gathered many species until relatively recently and they believed that the most damaging changes occurred within the last generation. These observations confirm the period of 1970-1980 as a time of change.

The alienation of lands and resources has seen the mahinga kai practices of Ngai Tahu transformed. This transformation occurred at a time when resource degradation and environmental crises have precipitated the search for alternatives to dominant management systems (Berkes, 1991, 1994; Pinkerton, 1989). Traditional knowledge (or in the New Zealand context Matauranga Maori) is increasingly promoted as a valuable addition to scientific knowledge. However it must be recognised that the application of Matauranga has been disrupted and subject to interference. Nevertheless for some whanau, for some resources, in some areas, there has been regular, relatively uninhabited resource use through the generations. As the interviews and Kai Consumption Survey show many Ngai Tahu continue to gather and consume kai awa, kai roto and kai moana.

The fact that kaumatua contend that the most damaging changes have occurred in the current generation when considered alongside the data showing that the 10% of respondents who don't eat kai are all rangatahi suggests the assimilation of Maori into mainstream New Zealand lifestyles and diets is continuing and that the loss of some mahinga kai practices may be quite marked in younger whanau members.

In South Canterbury, the declining abundance of aquatic species at many sites across Canterbury is attributed to water quantity issues arising because of excessive extractions, changes in flow patterns as a result of damming, and demands to divert or drain waterbodies. This clearly has the potential to place Ngai Tahu in confrontation with development interests as:

- The streams valued and utilised by Ngai Tahu are those most stressed.
- Currently 88% of water allocated in Canterbury is used for irrigation.
- Ngai Tahu believe some of the current land uses (that are totally dependent upon water supply) are unsustainable.

Interviewees believed that summer withdrawals leave some stretches of riverbed almost dry. The water is left dribbling in channels and gets lethally warm and polluted with agricultural runoff. Fish migration – upstream and downstream – is also severely compromised. In some catchments fish

survival is dependent on access to isolated and disconnected large pools. Of particular relevance to consideration of contaminant levels, is the reduced assimilative capacity of waterways when only minimum flows are maintained – often for significant periods of time during summer.

More recently Ngai Tahu have been denied access to kai due to increased gathering pressure by ethnic groups who either do not know or respect the tikanga and/or rules that regulate gathering.

Despite the level of environmental change and the potential for contamination, it needs to be acknowledged that lifestyles today leave little time for fishing activities.

Changes to the health of the waterbodies and consequently the relationship of whanau with aquatic resources have resulted in a range of health and wellbeing implications for Ngai Tahu whanui. Although the implications emerge from the data they are quite subtle with some informants describing the effects without explicitly "labelling" it as an effect. However, despite this, the links between aquatic resources and health and wellbeing are evident in the sense that they are 'just below the surface' for many of the participants. It is possible that because the themes presented are widespread amongst the interviewees they are also widespread amongst the rest of the hapū, especially the older members who have experienced a lot more of the changes presented in this report first-hand.

1. Introduction

1.1 Background

Waterbodies impacted by pollution and suffering environmental degradation represent a risk to the health of both aquatic organisms and humans. Even at low concentrations contaminants, particularly organic compounds, can cause long-term impacts and pose significant risks to the health of biota and humans. In the aquatic environment, contaminants transported by the air and in the water are highly likely to be deposited in sediments, where in turn, fish and shellfish are exposed. Contaminants are generally stored in the lipids of biota and can be biomagnified up the food-chain. Human health may be threatened either by the direct consumption of fish and shellfish contaminated with pollutants, or by direct exposure (via water and atmosphere during collection) to them (Boesch and Paul 2001).

Concerns about the potential accumulation of contaminants in fish and other wildlife, which commonly form a component of indigenous peoples' diets, and their consequent potential effects on human health, has led to a worldwide proliferation of studies examining the effect of environmental contaminants on fish, wildlife and communities. For example, leading international indigenous contaminant research programmes, e.g., the Northern Contaminants Programme (NCP) and the Effects on Aboriginals from the Great Lakes Environment (EAGLE) Project were established in response to concerns regarding the exposure of humans to elevated levels of contaminants in the traditional subsistence diets of indigenous peoples. Research to date has shown that certain indigenous communities have elevated contaminant levels due to exposure through their traditional diet (Hoekstra et al., 2005; Johansen et al., 2004; Odland et al., 2003; Van Oostdam et al., 1999; Van Oostdam et al., 2003). In addition, fish and wildlife are used as indicators of the health of the ecosystems.

The impact of environmental contamination on the resident "wild kai", and in turn, on Māori iwi/hapū consuming them, has not been investigated to date. A recent review of wild food in New Zealand identified gaps in knowledge of contaminants in non-commercial wild-caught foods, especially in terms of consumption levels (and hence exposure) (Turner et al., 2005). A resulting draft position paper identified a need for information and education on contaminants in kai (NZFSA 2005). In response, the National Institute for Water and Atmospheric Research (NIWA), in conjunction with Tipa & Associates and iwi research partners, Ngāti Hokopu ki Hokowhitu, Te Arawa Lakes Trust and Te Runanga o Arowhenua initiated a programme of research to investigate the contaminant levels and risk to Maori health associated with 'wild kai' – food gathered from the sea (kai moana), rivers (kai awa), and lakes (kai roto). This research, funded by the Health Research Council over a three year period, ultimately

aims to improve Maori health by identifying, quantifying, and effectively communicating the risks associated with the collection and consumption of wild kai.

1.2 Research Rationale

Traditionally, Maori had their own knowledge systems of how the environment contributed to health and well-being. Wild kai, gathered from the sea, rivers, and lakes, has always been an integral component of Maori lifestyles, but today is increasingly susceptible to contamination. The impacts of environmental contamination in wild kai on Maori have not been investigated to date. The present research sought to address this shortcoming.

As part of the first phase of the research, Maori from three communities were asked to identify species, locations and quantities of kai moana, kai roto and kai awa consumed. This was to enable the levels and types of contaminants in the kai to which Maori are exposed to be determined.

While it could be argued that contamination of wild kai has the potential to directly impact the physical health of Maori, the impacts of contamination and/or loss of an important cultural activity on wellbeing have also been explored during the course of the project. Maori associate their well-being as individuals and as members of whanau, hapu and iwi, with maintaining the health of the natural environment (Durie 1994, 1998, Panelli and Tipa 2007, 2008). Maori strongly believe that the whenua and tangata are inextricably intertwined, and when one of these becomes unbalanced, the other equally suffers (Harmsworth and Warmenhoven 2002; Sims and Thompson-Fawcett 2002). Therefore, the sustainability of the natural environment and the long-term well-being of Maori are seen by some Maori as one and the same thing (Panelli and Tipa 2007). This is consistent with conceptualisation of wellbeing proposed by other indigenous communities (Adelson 2000, Greiner et al., 2005, McLennan 2003, McLennan and Khavarpour 2004, McGregor et al., 2003). Customary and recreationally gathered "wild kai" resources are therefore of significant cultural, recreational and economic importance in both traditional and contemporary Maori society (Waitangi Tribunal 1983, 1984, 1987, 1988, 1989, 1991, 1992, 1995, 1998)[1].

The majority of the international research in the area of contaminants in the traditional diets of indigenous peoples has primarily focused on the levels and health effects of exposure to heavy metals and organochlorine contaminants through the consumption of marine fish and mammals in peoples from the northern hemisphere, i.e., the Inuit people of northern Alaska, Canada and Greenland (Hoekstra et al., 2005; Johansen et

[1] The evidence submitted to the Tribunal by Iwi, and the summary reports from the Tribunal itself provide a graphic depiction of the significance of gathering kai for whanau, hapu and iwi.

al., 2004; Odland et al., 2003; Van Oostdam et al., 1999). Research to date has shown that certain Inuit communities have elevated contaminant levels (e.g., mercury, lead and chlordane) due to exposure through their traditional diet (Van Oostdam et al., 2003).

It is unlikely that contemporary Maori communities have been exposed through their diet of "wild kai" to the levels of organochlorine contaminants as high as those observed in indigenous populations residing in the northern hemisphere (due to occurrence of large mammals in the customary diet of Inuit). However, the impact of environmental contamination on the resident "wild kai" and, in turn, on Māori iwi and hapu consuming them, has not been investigated to date. In addition, while existing consumptive advice is available for some species of relevance to Māori, this advice is based on average national consumptive patterns and doesn't account for potentially higher consumption rates of specific traditionally harvested foods by Māori, with its concomitant elevated exposure risk. Māori utilise kai from rivers, lakes and the oceans (as well as the land).

This research aims to identify and communicate the risks posed by the presence of environmental contaminants in the kai moana, kai roto and kai awa to the Maori communities that gather these resources. Major outcomes of the research will be development of a generically applicable risk assessment framework, and Maori-targeted risk communication strategies. It is envisaged that the research will be of interest to the wider Maori community, non-Maori, public health providers, as well as indigenous peoples worldwide for whom fish and shellfish constitute a major part of their diets.

1.3 Research aim

The overall aim of our research project is:

> *To determine to what extent locally available kai moana, kai roto, kai awa, and the associated aquatic environments pose a health risk to tangata whenua.*

Successful frameworks for undertaking research in a manner that is culturally acceptable, and which ensures the protection of intellectual property rights, were developed between NIWA and Ngāti Hokopu and Te Arawa during the HRC and FRST funded programmes 'The Revitalisation and Enhancement of Matauranga Hauora of Aquatic Environments (C01X0226)' and 'Sustainability and Management Framework for Te Arawa Lakes' Customary Fisheries (CO1X0305)'.

Memoranda of Understanding between NIWA and Ngāti Hokopu ki Hokowhitu, Te Arawa and Te Runanga o Arowhenua have been established to formally record the expectations of conduct between NIWA and the respective parties with respect to the present research.

Three Maori communities were involved in the overall research:

- Te Arawa: centred around the Rotorua Lakes;
- Ngāti Hokopu ki Hokowhitu: centred around Whakatane; and
- Te Runanga o Arowhenua: centred on South Canterbury.

These communities were selected on the basis of previous contact (and research projects underway) with key researchers. Permission was obtained and confirmed by a sub-contractual agreement.

The three communities differ in their access to and use of aquatic resources. Each community is characterised by different physical, natural, social and political capital which directly impacts the level of kai awa, kai roto and kai moana gathered and consumed. In each region the diversity of aquatic ecosystems utilised, with spatial and temporal patterns of gathering unique to the each place and community, reflect a history of complex, locally specific tikanga and kawa driven behaviours. Exploring the complexity of this inter-community variation was beyond the scope of this research.

There are four main stages to the research project:

1. Objective 1: The first stage involves interviews with key informants and undertaking a survey to identify what kai moana species are harvested and eaten by iwi/hapu members from Ngāti Hokopu, Te Arawa and Te Runanga o Arowhenua, and the aquatic environments they are currently sourced from.

2. Objective 2: The second stage identifies the types and levels of contaminants present in the “wild kai” and associated habitats identified by Maori.

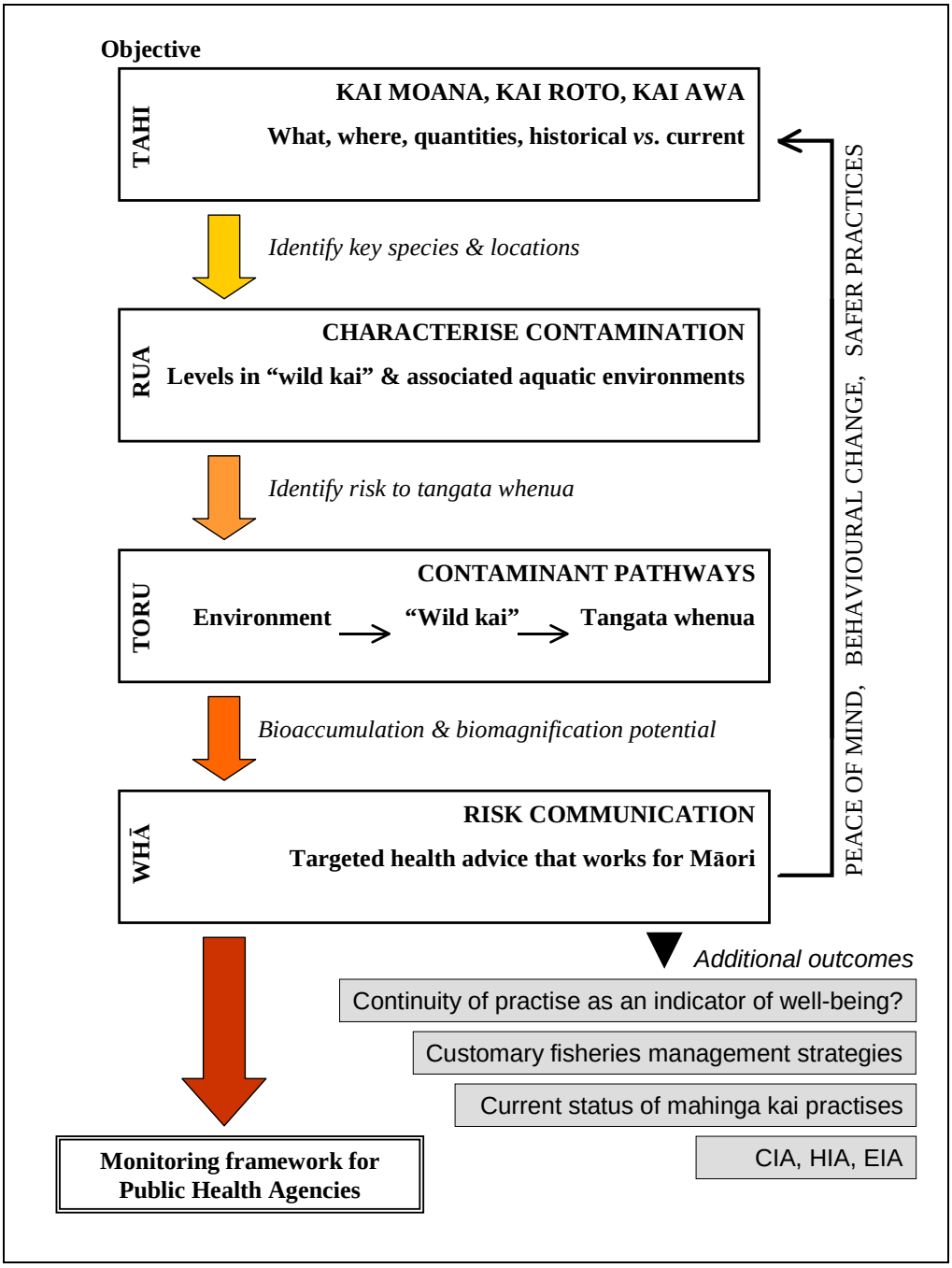
3. Objective 3: This stage establishes potential pathways of contaminant bioaccumulation via the food web utilising methyl mercury as an example of a bioaccumulative contaminant.

4. Objective 4: This stage identifies the potential health risks associated with the collection and consumption of contaminated “wild kai”, and develops risk

consumption advice specifically targeted at Maori, that will take into consideration both the benefits and risks associated with eating kai moana, kai roto and kai awa.

Figure 1 provides a graphic representation of the identified research priorities, the objectives, and possible outputs.

Figure 1: Research priorities, the objectives, and possible outputs.



The first objective of the research (to provide a description of the kai moana, kai roto and kai awa collection, processing and consumption patterns of iwi/hapu members) is clearly a precursor to Objectives 2–4. This first stage identifies:

- What types of kai have been collected and/or eaten in the last 2–3 generations (e.g., species, life-stage, abundance)?
- Where were/are they harvested from and when (e.g., location, ecosystem, season, time of day, life-stage)?
- How is kai moana stored and processed for consumption?

This report documents the results of the first phase of the above research programme, specifically investigating the level of kai consumed by whanau in South Canterbury and the potential effects of environmental contamination on their physical, spiritual and cultural well being.

To elicit the data needed we included methods that have been used previously with hapu around New Zealand. This approach consisted of focus groups and hui, followed by interviews. For this objective it was important to assemble a group of willing participants with knowledge and experience of kai gathering in the takiwa (area) and rohe.

1.4 Report Structure

This report has been divided into a number of sections:

Section 1 Sets out the background and the aims of this study.

Section 2 Describes the methodology that was used.

Section 3 Provides some information on Te Runanga of Arowhenua and their takiwa in South Canterbury region.

Section 4 Outlines international developments within which the research is situated, specifically:

4.1 indigenous communities and participatory approaches to management and research;

4.2 contemporary wellbeing research, and implications for this study;

4.3 international observations of the impact of changing diets;

4.4 effects of contaminants on health;

4.5 Maori conceptualisations of health and wellbeing.

Section 5 Introduces the empirical analysis by outlining the quantitative research results; specifically with respect to contemporary patterns of gathering. This chapter is informed by the Kaimoana Consumption Survey.

Section 6 Based on the results, develops a broader understanding of the importance of kai awa, kai roto and kai moana within the wider socio-economic-cultural activities of whanau and hapu. It provides a brief comparative analysis by discussing the contemporary patterns alongside historic traditional patterns. It pulls together the qualitative and quantitative research results and identifies main themes that are then discussed in the context of international literature.

Section 7 Returns to the original kaupapa of the research and discusses the next steps in the research process. The report concludes with observations of how social, cultural and political meaning associated with kai gathering could inform the management of such resources within the community.

5.1 historic, traditional patterns of gathering;

5.2 changes to traditional lifestyles; and

5.3 contemporary patterns of gathering.

Section 6 Then moves away from presenting the quantitative results to develop a broader understanding of the importance of kai awa, kai roto and kai moana within the wider socio-economic-cultural activities of whanau and hapu. It reflects and pulls together the qualitative and quantitative research results in the context of international literature.

Section 7 Returns to the original kaupapa of the research and discusses the next steps in the research process. The report concludes with observations of how social, cultural and political meaning associated with kai gathering could inform the management of such resources within the community.

2. Methodology and Data Analysis

There is growing recognition of the significance of aquatic habitats and the resources found within them that sustain indigenous communities. Yet this recognition has not been accompanied by investigations to increase understanding of the specific contribution of aquatic habitats and resources to the health and wellbeing of communities depending on these resources.

Drawing on the earlier work of Bebbington (1999), importance to whanau was examined according to:

- the instrumental role – the significance of rivers, lakes and coastal environments as a source of physical health (specifically nourishment); and

- the hermeneutic role - the ways in which kai awa, kai roto and kai moana give meaning to the lives of whanau and hapu. Contemporary research seldom examines the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana, which when communicated to policy makers in the absence of empirical data, are often dismissed as anecdotal. Finally, kai awa, kai roto and kai moana (and the waterbodies from which they are sourced) are examined in terms of their cultural embeddedness of whanau and hapu.

This section of the report outlines the methodology employed, but starts with a description of the Maori community studied.

2.1 Study area

As previously stated, this report details the results of one case study: Te Runanga o Arowhenua. Participants living in South Canterbury were recruited from Te Runanga o Arowhenua members. Availability to take part in the research was the only exclusion criteria, although the preference was for key informants to be active kai gatherers. The study was undertaken under Ethics Approval MEC/07/07/088 and all participants gave written informed consent.

2.2 Methodology

The research team utilised two research methodologies to contrast the instrumental and hermeneutic role of aquatic resources as a source of kai awa, kai roto and kai moana. The first was a quantitative survey of wild kai consumption using a questionnaire, while the second incorporated participatory research techniques via a focus group and a series of qualitative interviews.

The survey followed once the interviews were complete. This was to ensure that the sites and species about which data was sought in the questionnaire were identified by the hapu, and not predetermined by researchers.

2.3 Quantitative survey - Kaimoana consumption survey

The Kaimoana Consumption Survey questionnaire was adapted from a range of other studies (including diet surveys, fish consumption surveys, traditional use surveys, surveys of the health of indigenous communities and perception/preference surveys). The survey questionnaire was approved as part of the Ethics Committee approval process.

2.3.1 Kaimoana consumption: quantifying importance of sites and species

We examined consumption using a food frequency questionnaire with frequency categories ranging from less than once per month to one or more times per day. Consumption is one of the principal means by which the importance of kai awa, kai roto and kai moana and the intimate and dependent relationship with aquatic environments from which they are sourced can be determined.

2.3.2 Existing estimates

Kaimoana consumption records in New Zealand are sparse. Estimates were derived using data from the questionnaire by calculating the amount consumed and the frequency of consumption.

2.3.3 Seasonal variation

Some species of kai awa, kai roto and kai moana are seasonal resources while others are open access. Seasonality is explained in historical literature recognising that tikanga and kawa was attuned and responsive to the life-cycle of the different species. Therefore, questions in the survey identified where possible seasonal patterns of contemporary gathering.

2.3.4 The impact of kai awa, kai roto and kai moana on whanau and hapu livelihoods

Arguably there is a need for a broader understanding of the importance of aquatic resources as a source of kai beyond the simplistic statements of mahinga kai that often accompanies ecologically based descriptions of aquatic ecosystems. The questionnaire sought to address this need by analysing the complex relationship that whanau have with waterbodies found in their takiwa.

2.3.5 Other

Other data gathered included:

1. demographic information, such as the prevalence of certain medical conditions, lifestyle factors including risk-related behaviours, and family history;

2. self-reported heath status using a generic, health-related quality of life questions;

3. kai gathering locations; and

4. perceptions held by whanau members about the importance of aquatic ecosystems and species, and their assessment of the health of these resources.

2.4 Qualitative methods

The qualitative methods used here address the first of the research objectives as stated in Section 1.3 above. Methods involved an introductory hui, a focus group session, follow-up interviews, informal discussions with many people and reviewing secondary data sources (documents).

2.4.1 Literature review

An examination of relevant literature was undertaken for five reasons

1. to provide a more comprehensive understanding of historical resource use and patterns of activity in the study community;

2. to gain an appreciation of the changes to the aquatic habitats over time, as perceived by participants;

3. to identify the changes over successive generations that have impacted on kai gathering behaviours;

4. to understand the aspirations of Te Runanga o Arowhenua to address issues of concern with respect to waterbodies; and

5. finally, to ascertain if and how agencies have responded to the stated aspirations of participants.

Qualitative data were collected from published and unpublished documents, from libraries, the Waitangi Tribunal (evidence to the Tribunal and reports from the Tribunal), statutory and iwi plans, and statutory planning documents. Internet searches also yielded further material.

2.4.2 Participatory methods

Before working with Te Runanga o Arowhenua, an introductory presentation was given at a monthly runanga meeting during which the participatory process was outlined. Two participatory methods were incorporated into the research: a focus group and interviews with key informants. At the start of all interactions (focus group and interviews) the roles and obligations of participants and researchers were discussed.

Focus group

A focus group was convened at Temuka in April 2008. Seven participants attended the focus group. The participants were engaged in a guided discussion lasting 1–1.5 hours. The focus group followed the framework of questions presented in Box 1. This second session focused on gaining a broad understanding of the spatial extent and description of aquatic resources from which kai awa, kai roto and kai moana were sourced, and the overall importance of each waterbody and species to whanau and hapu. Maps were used to record information about species, locations and other relevant information. Discussions of the focus group were taped.

In depth semi-structured interviews

In the weeks following the focus group meetings, follow-up interviews were conducted. The purpose of these interviews was to collect additional and more detailed data related to the location and types of kai collected and consumed, and factors that may have influenced gathering. Interviews also covered preparation technologies and processes, and specifics about consumption. The questions used for the focus group were also used to guide the interviews that probed more deeply into the personal experiences, thoughts and feelings of the individuals. The intention was to identify and explore the diversity and complexity of relationships and gain a comprehensive understanding of the changes to aquatic environments and the emergent issues seen as potentially impacting health and wellbeing as perceived by different individuals. Interviews were carried out with 10 individuals resident in South Canterbury. Each interviewee was identified by Te Runanga o Arowhenua.

BOX 1: QUESTIONS AT THE FOCUS GROUP & INTERVIEWS

Species of kai

- What (species of kai) did you gather when you were young?
- What places can you remember visiting to gather kai when you were growing up?
- Did you collect year round or seasonally?
- Can you recall any places that you were told not to go to for kai?
- Were there any times / occasions that you were unable to gather kai?
- How long did it take to gather the kai that you needed?
- What (species of) kai do you gather today? What places do you use today?
- Do you gather kai year round or is it seasonal?
- What events / conditions etc. stop you from gathering kai?
- How often would you or someone in your whanau go out to gather kai?
- How long does it take to gather kai compared to when you were younger?
- What species / sites have you lost over the years? When and why did you stop using them?

Behaviours with kai

- Is kai shared? With whom? Has this changed over your lifetime?
- How was kai prepared? Has this changed?
- What methods are used to collect kai? Has this changed?

Condition of kai

- What quantities were taken when you were younger? What quantities are taken today?
- What was the condition of the kai when you are younger? How does this compare with what is taken today?

Observed and known changes

- What changes to the experience of gathering kai h you observed? How has this affected you and your whanau? How have you adapted to these changes?
- What changes to the habitats have you observed and how have these affected you?
- What sort of things would you like to see happen in the aquatic environment you associate with and why?
- Are you happy with your current level of access to kai that you value? What are the main barriers you face today?

Wider benefits of gathering kai

- What do you like about being able to go and gather kai?
- When you gather kai are you with other whanau or hapu members?
- What rules or beliefs do you follow with respect to gathering kai?
- Do you feel any special attachment to the places from which you gather your kai?

Health risks

- Do you know of any health risks associated with gathering kai?
- If you were told not to gather kai from an area because of the health risks would you still gather from there?
- What type of information would you need to help you decide whether to gather kai from an unsafe site?

Informal interaction

It must be noted that the formal methods were augmented by many instances of informal discussion, as is the case in most qualitative research.

There were two principal outputs, the first being a map documenting the types, locations, and quantities of kai moana collected and consumed by those present. This was complemented by an analysis of discussions concerning when gathering was undertaken, and the processes used to prepare the kai.

2.5 Qualitative data analysis

In summary, informants were interviewed and interacted with in different forums, and their written documents (both historic and contemporary) and submissions provided further context for interpreting their values, practices, activities and concerns. Accessing multiple sources of data was one of the methodological tools employed to ensure the validity of data collected.

Lincoln and Guba (1985, 224-225) contend that the role of data analysis is "to 'make sense' of the data in ways that will, first, facilitate the continuing unfolding of the research, and second, lead to a maximal understanding of the phenomenon being studied in its context". There were two aspects to the data analysis:

1. firstly to identify sites and resources to be sampled for analysis of contaminant levels; and

2. secondly, the analysis involved identifying, sorting and grouping data from very detailed individual transcripts to identify key themes. The methods of data collection resulted in a considerable quantity of raw data being gathered, and data from a variety of sources had to be systematically analysed.

Data were broken into stand-alone pieces of information, coded and categorised. Categorisation of the data enabled similar themes to be distilled. Some of the themes had been established a priori based on key issues that had emerged while reading related literature and undertaking preliminary discussions when scoping the research topic and negotiating entry to the communities. The question of how to present the data collected from multiple (and mixed) methods was, at times, perplexing. Patterns began to emerge reflecting the diverse nature of the relationship each person had with aquatic habitats, and how and why they believe this relationship has changed over their lifetimes, i.e., how they perceived that these changes have made them feel and behave. Principal categories that were identified represent the headings under which the research findings are presented in sections 5 to 7.

Themes that were distilled from the documentary and interview data were compared with those that emerged from the survey by means of comparative analysis.

It is envisaged that summaries and drafts of this report and the composite report (with the results of the three hapu studies) will be presented and discussed at hui with members of each group.

Before concluding this section it is important to record that the lead researcher for this phase of the research is Ngai Tahu, trained as an environmental manager, employed to advocate in a variety of health and environmental fora for increased recognition of Ngai Tahu beliefs, values and practices, and has worked closely with Arowhenua for a number of years. This must be acknowledged, given the backgrounds from which the participants were selected. There was a possibility that participants gave answers that they thought "she wanted to hear". However by being aware of this possibility, by adopting a disciplined approach to ensure that throughout the data collection and analysis process there was constant referral to the research aims and objectives, and by utilising a range of methods to ensure the research was methodologically sound, the research findings presented in the next section of this report are a fair and accurate interpretation of the data collected.

2.6 Quantitative data analysis

The questionnaire was constructed on Survey Pro 5 (Apian Software Inc) and all data were entered into this programme. The results that are reported in section 5.2 and discussed in section 7 have been produced using the Survey Pro reporting functions. Microsoft Excel was used to construct two of the graphs.

2.7 Summary of methods applied

The methods applied to enable us to understand kai gathering behaviours over different time periods are set out in Table 1.

Table 1: Methods used during the course of the research.

PRE-EUROPEAN SETTLEMENT	19TH CENTURY POST EUROPEAN SETTLEMENT	20TH CENTURY UP TO 1970S – 1980S	PRESENT DAY
Manuscripts	Maori Land Court	Interviews	Interviews
Cultural maps	Land titles for		Review of
Historical texts	Evidence to Royal	Evidence to the	Kai Consumption
Evidence to Royal	Evidence to the Waitangi Tribunal	Photographs	
Evidence to the	Paintings		

3. Study Group

Te Runanga o Arowhenua

The legal identity of Te Runanga o Ngai Tahu is established in the Te Runanga o Ngai Tahu Act 1996. It is the tribal representative body of Ngai Tahu whanui. It is a body corporate, established on 24th April 1996 under section 16 of the Te Runanga o Ngai Tahu Act 1996. Pursuant to section 3 of that Act, "*the Act binds the Crown and every person (including any body politic or corporate) whose rights are affected by any provision of this Act"*.

The members of Te Runanga o Ngai Tahu are the 18 papatipu runanga, each of which is defined in the Act, as is the takiwa for each. Te Runanga o Arowhenua is one such runanga. This establishes who holds manawhenua rights over specific lands and waters within the rohe of Ngai Tahu. Te Runanga o Arowhenua has its offices at the marae at Arowhenua. As one of the 18 papatipu runanga, the takiwa of Te Runanga o Arowhenua, as defined in the Te Runanga o Ngai Tahu Act 1996, centres on Arowhenua and extends from Rakaia to Waitaki, and thence inland to Aoraki and the Main Divide. Figure 2 shows the papatipu marae at which the runanga office is located, while the rohe of Te Runanga o Arowhenua is shown in Figure 3.

Figure 2: The wharenui "Te Hapa o niu Tireni" at the marae at Arowhenua[2].

[2] Photo by Adrienne Rewi http://adriennerewiimagines.blogspot.com/2008_11_01_archive.html

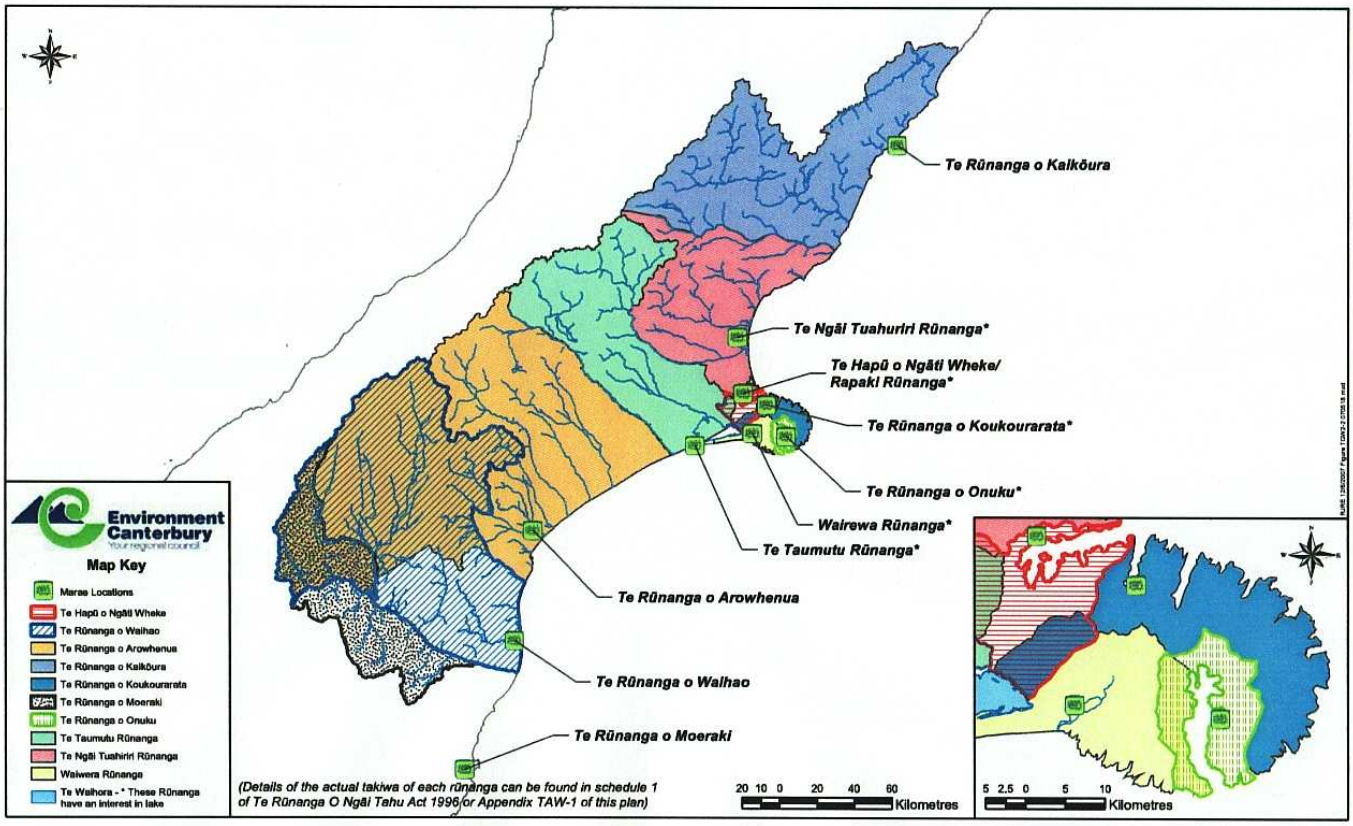


Figure 3: The takiwa of Te Runanga o Arowhenua (Source: Environment Canterbury Natural Resource Regional Plan http://www.ecan.govt.nz/our-responsibilities/regional-plans/nrrp/Pages/read-plan.aspx).

4. International developments relevant to the research

Consistent with the need for the present research to be examined in a context of international literature and academic thought, this section seeks to position the research design and data analyses within contemporary writings from four related areas:

- indigenous communities and participatory approaches to management;
- contemporary wellbeing research, and implications for this study;
- international observations of the impact of changing diets and effects of contaminants on health; and
- Maori conceptualisations of health and wellbeing.

4.1 Indigenous communities and their participation in management

This research sought to utilise participatory research methods. Participation is seen as a means of affording affected parties the opportunity to articulate their interests, enhancing the quality of information available to decision makers; enhancing the potential for support of decisions by enabling early and meaningful involvement; and affecting one's destiny as the opportunity to participate in decisions is a key element of self-empowerment and self-actualisation (Fenge, 1994). In the context of this research project, in addition to collecting environmental contamination data, the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana are examined, and empirical data collected for use by whanau and hapu.

Participatory approaches to environmental management received emphasis initially in the Brundtland report (WCED 1987) and in Agenda 21, at the 1992 ‘Earth Summit’. Perhaps the greatest significance of these fora lay in the acknowledgement that sustainable development would require new approaches to environmental management, and that effective environmental management would need to be differentially negotiated within individual states, even within individual communities. In effect, this research will also result in a range of cultural values and perspectives of particular aquatic locations being documented and available to each Maori community to inform local processes of management should they so choose.

Pimbert and Pretty (1997) contend that new partnerships and connectedness between different interests is required in environmental management and argue that

participatory processes must be locally grounded which will likely require different solutions for different places. This research will facilitate new participatory processes between environmental managers, public health managers, science agencies and Maori. Despite the increase in participatory initiatives, Pimbert and Pretty (1997) also warn that the call for peoples' participation risks becoming a catch-cry and part of the conventional rhetoric without delivering meaningful outcomes for participants. This warning reinforced the desire of the researchers to deliver a meaningful and effective process for application by Maori and outputs such as those listed in Figure 1 for use by Maori and resource managers.

The drive for greater participation has been paralleled by a concerted drive by indigenous communities to reassert their customary and Treaty rights to access and use land and water resources and greater recognition of the knowledge held within communities including indigenous communities (Western et al, 1994, Pinkerton 1989, 1992, Notzke 1994, Berkes and Folke 1998). Although a range of terms are used, often interchangeably, Berkes (1999) defines indigenous knowledge as that knowledge held by indigenous peoples and traditional ecological knowledge as a subset of that – a practical knowledge of species and beliefs regarding human interaction with the ecosystem. Menzies and Butler (2008) list the attributes of traditional ecological knowledge as cumulative (from long term intergenerational interaction), dynamic (informed by a customary lifestyle but not unchanging), providing a historical understanding of change, local, holistic (viewing all elements as interconnected), embedded (in a unique matrix of local, cultural, historical and traditional elements), moral and spiritual. In order to understand the changes to the diets of successive generations of Maori, the research team was dependent on key informants being experienced and knowledgeable (with indigenous knowledge and/or traditional ecological knowledge) about kai gathering.

Sadly, Maori, like other indigenous communities have witnessed the destruction of valued environments and their alienation from the resource bases upon which their cultures and identities are constructed (Berkes 1991, 1994, 1999). Documenting the changes that have been experienced in South Canterbury and the impacts on whanau and hapu, including a profound sense of loss, was therefore vital.

The growth of interest in the knowledge held by indigenous communities is related to the wider shift within resource management to an ecosystem based management approach (Menzies and Butler, 2003) and recognises that indigenous communities understand the way species interrelate and how ecosystems work as a whole. It recognises that indigenous communities have a well developed understanding of the local environment and their own impacts on local ecosystems. The data collected via the interviews and questionnaire confirmed the proposition of Berkes (1999, page 33) that the "use of traditional knowledge may benefit development by providing more

realistic evaluations of local need, environmental constraints and natural resource production systems".

Initiatives involving the incorporation and/or application of indigenous knowledge are emerging around the world as resource managers seek to engage with indigenous communities. New Zealand has also experienced the drive for greater participation, including greater recognition of the beliefs, values and practices of Maori. In 1991, the Resource Management Act 1991 became the governing legislation for resource use in New Zealand (Davis and Threfall 2006). Two sections are of particular relevance.

Section 6 requires that anyone exercising functions and powers under the Resource Management Act 1991 recognise and provide for matters of national importance including "the relationship of Maori and their cultures and traditions with their ancestral lands, water, sites, *wahi tapu* and other *taonga*" (section 6(e)). Gathering from tribal lands and waters, species that are often accorded the status of "taonga", clearly falls within the gambit of section 6(e) and is thus a matter of national importance.

Pursuant to section 7(a) decision-makers are required to have particular regard to *kaitiakitanga*. The Act presently defines kaitiakitanga as:

> *The exercise of guardianship by the tangata whenua of an area in accordance with tikanga Maori in relation to natural and physical resources; and includes the ethic of stewardship based on the nature of the resource itself.*

The responsibilities of Tangata Kaitiaki are to protect the integrity of resources (including the kai species identified by informants). This requires Maori to focus on long term environmental results, which are likely to include healthy ecosystems with abundant populations of valued kai species that are able to sustain cultural uses well into the future. Despite these encouraging and potentially enabling provisions, often there is little guidance given to managers and regional bodies seeking to meet the obligations to indigenous communities (a challenge Maori confront in New Zealand). This research seeks to produce outputs that will guide both Maori and non-Maori resource managers.

4.2 Contemporary wellbeing research: implications for this study

For indigenous communities food is not just a resource for sustenance as many might understand it in western contexts (Slocum 2007). Rather, Panelli and Tipa (2007, 2008) argue, that food needs to be understood in a wider cultural context that interweaves complex indigenous cultural and environmental relations.

Panelli and Tipa (2007, 2008) contend that to identify these relationships primarily by a particular bio-physical character (e.g., forests, coasts and waterways) misses the range of spiritual, physical, social, material, cultural, economic and political relationships that might be involved in any one case. The complexity of these relationships must be appreciated before the significance of an 'individual' phenomenon or activity (such as food or food gathering) might even begin to be approached (let alone the cultural or health implications of such things). They further contend that to consider kai gathering without this contextual understanding would diminish its cultural value and the rich dimensions that underpin whanau and hapu experiences of identity and well-being. The results of the Kai Consumption Survey reported in subsequent sections of this report support the proposition that individual experiences of interviewees vary as lives are influenced by a complex combination of: cultural beliefs, values and uses; a history of colonization, loss of lands, alienation from their lands, waters and resources; and contemporary interactions with a dominant non-Maori world that is based primarily on capitalist, western values (Panelli and Tipa, 2008). The range of perceptions, preferences and the experiences of members of Te Runanga o Arowhenua that emerged from the analysis of data collected for the present research are set out in sections 5 – 7 of this report.

Indigenous communities have traditionally been resource users and developers (O'Regan 1984, Notzke 1994). They used natural and physical resources for subsistence (physical survival) and sustenance (spiritual survival). Internationally there are calls to recognize and protect cultural knowledge and practices that are 'fundamental for food security and well being' (FAO 2007). Gombay (2005: 418) explains the significance of this stance, and when describing the Inuit argues that when they:

> *hunt, fish, or gather food the material and immaterial worlds blend together, with layer upon layer of meaning and understanding. The getting of country foods is about understanding the land in which one lives. It is about building an awareness and knowledge of one's place in the natural world ….*

The gathering, exchange and consumption of kai are also significant cultural activities for Maori. Complex associations with the environment and mahinga kai have developed over centuries and include social, economic, psychological, spiritual and physical dimensions that are an intrinsic part of health and well-being of whanau members. Diversity is wide (as evidenced by the individual variation from the survey results) but this is considered acceptable within whanau and hapu. The data collected helps explain how sourcing kai from lands and waters reaffirms firstly, connectedness with the lands and waters to which one has whakapapa, and secondly ensures continuity of practices initiated and valued by tupuna. In the Ngai Tahu context, mahinga kai practices also enable social and environmental responsibilities to be

fulfilled. To be denied the opportunity to manaaki visitors to one's home and marae would have consequential adverse effects on the health and well-being of Maori – a point that may be experienced beyond the individual and whanau level.

4.3 Maori conceptualisations of health and wellbeing

Durie (1994) introduced *Te Whare Tapa Whā* - a four sided house - or the four cornerstones of health; these being: *hinengaro* (mental well-being), *wairua* (spiritual well-being), *whanau* (family well-being) and *tinana* (physical well-being) which was subsequently adopted by the Ministry of Health (2006). Durie (2004) then proposed a second conceptualisation, *Te Pae Mahutonga*, which he contends represents the fundamental components of health promotion - *Mauriora, Waiora, Toiora* and *Te Oranga*. He explains that: *Mauriora* is dependent on a secure cultural identity; *Waiora* refers to healthy air, land and water environments which requires a balance between use and development and protection; *Toiora* focuses on personal behaviours and responsiblities; and *Te Oranga* recognises that health promotion (in particular increasing well-being) requires increased participation by Maori in societal affairs.

Another conceptualsation, by Pere (1997) emphasises reciprocity and interconnection between individual selves and wider social interests. In this sense, each experience of well-being would vary from place to place reflecting *whenua* (earth), *turangawaewae* (standplace), *whanaungatanga* (kinship), *whanau* (family), *wairua* (spirit), *hinengaro* (mind, heart), *whatumanawa* (feelings) and *tinana* (body). This conceptualisation by Pere helps explain connections between specific understandings of *whenua* and the social and cultural relations developed in particular places.

Panelli and Tipa (2008) explain how many Maori express a strong affinity for the earth and adhere to basic principles regarding their relationship with other aspects of creation and quote Crengle (2002) who explains all parts of the environment are related to one another and exist within a mutually inter-dependent whole. Deriving economic or social benefit from resource utilisation (recognised as contributors to wellbeing), must be carefully balanced.

Initiation of the current research programme and exploring the contribution of kai gathering to health and wellbeing is predicated on the belief that understandings of health and well-being can be enhanced by explicit conceptualisations that align spiritual, social and cultural elements in connection with bio- physical bases.

4.4 Effects of contaminants on health

While some agencies and researchers contend that people everywhere are exposed to chemical contaminants in the environment, international studies confirm that the majority of exposure to contaminants comes from food, with the consumption of contaminated fish identified as the largest single source of exposure in Canada (Health Canada 1997). Of concern, fish constitutes a significant dietary source of protein for many populations worldwide, especially indigenous communities.

Traditionally, the diet of many indigenous communities (including Maori) consisted of fish, game, waterfowl, and plants sourced from local lands, waters and coasts. Contemporary diets, in contrast, are likely to be a combination of traditional food items and more easily accessed commodity or convenience foods. Despite the change to convenience foods, traditional foods continue to underpin cultural identity for many indigenous communities. Delormier and Kuhnlein (1999) explain how changes experienced by Eastern James Bay Cree have affected diet, traditional food use, and nutrition. They contend that the reduced use of traditional food by younger generations, changes in fish consumption as a result of contamination, and increased incidence of obesity, diabetes, and cardiovascular disease within communities, represent particular socio-cultural concerns. Exploration of these issues and the longer term impacts has necessitated examination of the current diet and food consumption patterns of the Cree. The nature and extent of the risk that Maori confront in New Zealand is unknown but this research attempts to assess the risk.

If food is a major route of human exposure to many persistent toxic environmental contaminants the present research hypothesised that the consumption rates of aquatic species by Maori could represent a significant risk of exposure given their potential higher rates of consumption of these foods. The information gathered through the interviews and the questionnaire therefore had to enable the research team to establish whether there were any correlations between the contaminant levels measured in the participants' tissues (hair) (a separate component) and the fish or shellfish species they consumed in the past year. While such a relationship could not be considered as defining a direct cause:effect relationship, it would increase our understanding of the possible exposure risk to tangata whenua. We have also developed a model of potential contaminant accumulation pathways between participants and the kai they consume and calculation of relative risk, based on measured contaminant levels in kai species, their associated environments and consumers. Furthermore, the data had to enable the research team to assess the levels of contaminants in the respective fish and shellfish species consumed, by identifying important species and harvesting locations. These data were subsequently used to develop a sampling plan for kai species and associated environmental parameters. The results of these strands of research are to be presented elsewhere.

In risk management, the focus is on ensuring that mitigation strategies are culturally appropriate yet rarely are Maori perspectives or knowledge explicitly included in determining the hazards or health outcomes to be considered in the risk assessment. In the absence of explicit procedures to apply health risk assessment in Maori communities, the data derived from the questionnaires and interviews will contribute to the development of a health risk assessment model. Again using data gathered from this stage, we will develop Maori-focused guidelines with respect to the consumption of wild sourced kai and will also explore the appropriateness of existing information dissemination tools for effectively communicating risk.

5. Research results

In this section of the report we start by providing a description of the mahinga kai practices of whanau and hapu across South Canterbury prior to European settlement before profiling the present day behaviours of whanau members and highlighting changes from traditional lifestyles. Although challenging, we also seek to identify causes for the changes. The information relating to traditional practices is extracted from secondary data sources (including tribal manuscripts). Interviews with whanau members and the Kai Consumption Survey provided the data from which the contemporary profile was constructed.

5.1 Traditional patterns of gathering

From the oral histories of Ngai Tahu and written manuscripts, descriptions of a stable mahinga kai based lifestyle emerges. Evison (1993) describes how the great number of plants, birds, and fish that comprised the food sources of Ngai Tahu assured always that somewhere, something was available to eat. An outstanding characteristic was the sequential utilisation of a variety of natural resources from widely dispersed localities mirroring the cycles of rivers and species (Dacker 1990, Anderson 1988, 1998). This pattern of resource use shaped an itinerant lifestyle where mobility was pronounced and essential.

Movement and an understanding of the resources available over a wide territory were therefore crucial for sustaining the livelihoods of Ngai Tahu whanui prior to European settlement (WT[3], 1991, J10:99). Anderson (1998) described how the population dispersed during late spring to autumn to inland regions and retreated to long term settlements (typically nearer the coast) in winter and early spring.

Various resources which were seasonably abundant would be preserved and the food taken back to these more permanent settlements (WT, 1991 - H1:76–77). Other purposeful travels included inland hikoi to collect pounamu and the annual migration south to the Titi Islands in autumn to obtain titi (mutton birds). Mahinga kai was the basis of the Ngai Tahu economy and culture before contact with Europeans.

European settlement inevitably impacted Ngai Tahu mahinga kai resources and patterns of activity. Evidence given by Ngai Tahu whanui to Commissioner Mackay in 1891, who convened one of the Royal Commissions, stressed the loss of mahinga kai and the consequent adverse impacts on the lifestyles of whanau and hapu. While

[3] "WT" is used as an abbreviation of the Waitangi Tribunal.

fishing and eeling were still available to whanau and hapu, eventually these sources of food were also at risk (WT 1991, F11:51).

In this chapter we distinguish kai gathering in four time periods:

- pre European settlement;
- post European settlement – in mid to late nineteenth century;
- twentieth century up until the 1970s and 1980s; and
- the present (results of the present study).

5.1.1 Pre-European settlement - Traditional settlements and patterns of resource use

Ngai Tahu place names provide insight into the use of lands and waters, and the resources sourced from them. Individual Ngai Tahu within their living memory would have a mental map of important places that supported their itinerant lifestyle, including camping places, settlements, and the different resources that could be obtained and utilised - all held in memory like whakapapa, where the sequence and significance of every place was known (Kruptnik, 2002). The writings of ethnographers, such as Beattie, yield hundreds of place names[4]. Sadly, over time the location of many has been lost.

Figure 4 illustrates some of many place names found across South Canterbury and confirms widespread use of the region by Ngai Tahu. Each of the sites in Figure 4 represents a valued mahinga kai site that was instrumental in providing the resources essential to sustaining whanau and hapu. A summary of the mahinga kai sourced from these sites are shown in Figure 5 with a more detailed list of the 38 species obtained from these sites across South Canterbury presented in Table 2.

[4] Beattie recorded over 1400 place names for Canterbury. Other ethnographers obtained more.

Table 2: Species were traditionally gathered from across South Canterbury.

SPECIES				
Eels	Smelt	Flounder	Potato	Turnip
Rats	Seals	Whitebait	Whale	Aruhe
Sea nuts	Kanakana	Patete	Kauru	Flax honey
Flax	Panako	Kumara	Shark	Groper
Shellfish	Paua	Sea urchins	Tutu	Kokopu
Koareare	Weka	Kahawai	Cabbage	Kokopara
Kanaka	Pakihi	Minnows	Taramea	Birds
Mullet	Puha	Watercress		

The 1880 map and accompanying manuscript, commonly referred to as the "Taiaroa papers" by Ngai Tahu, represent a highly valued "cultural map". It was an initiative by kaumatua from neighbouring hapu and facilitated by H.K. Taiaroa, to map their collective territory, their mahinga kai interests and values associated with particular sites[5]. These records allow a more complete examination of the system of food gathering system within the Canterbury and Otago regions.

[5] Nearly 1400 places across Canterbury and Otago were written down and mapped which coincided with the Smith Nairn Commission enquiry (1881).

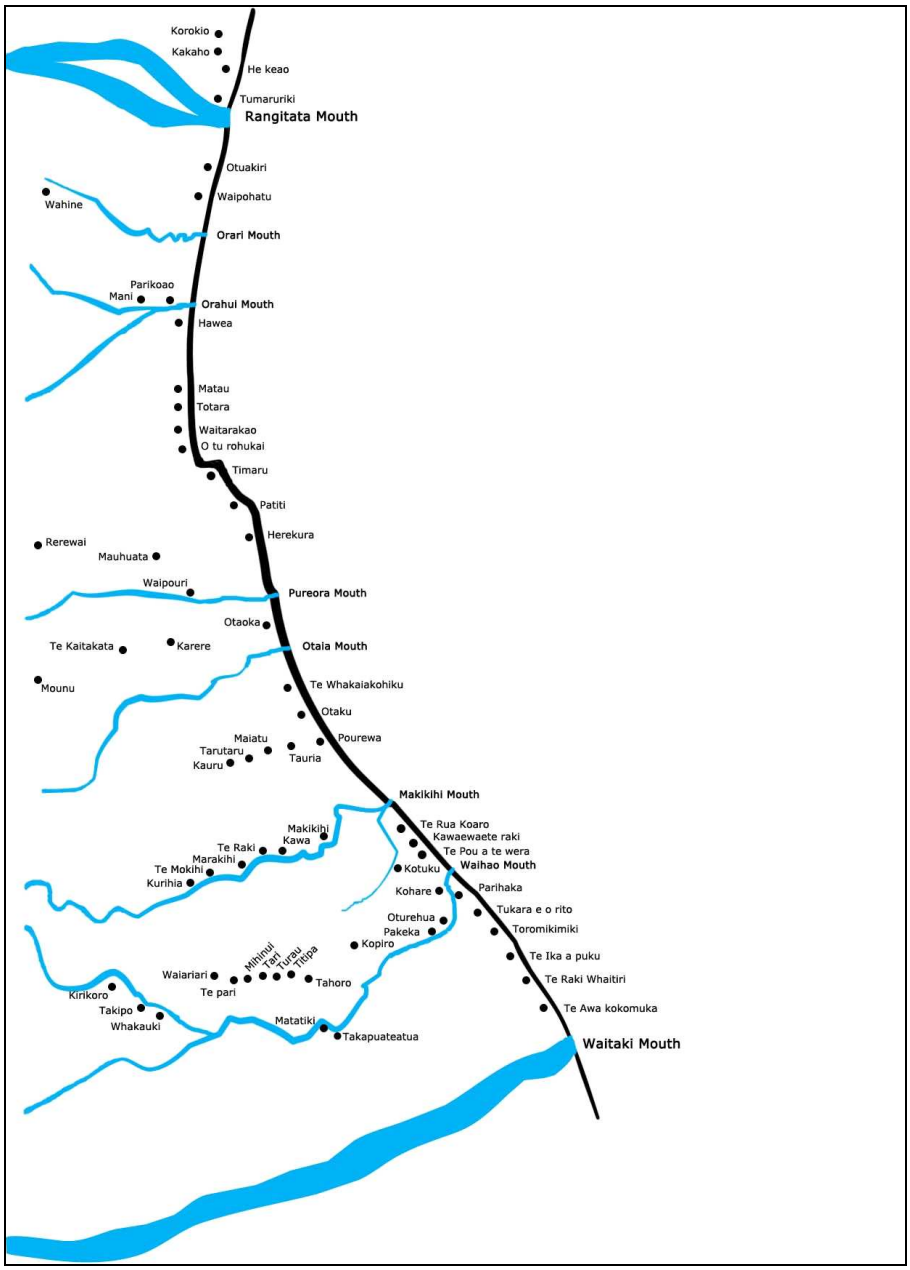


Figure 4: Traditional place names across South Canterbury.

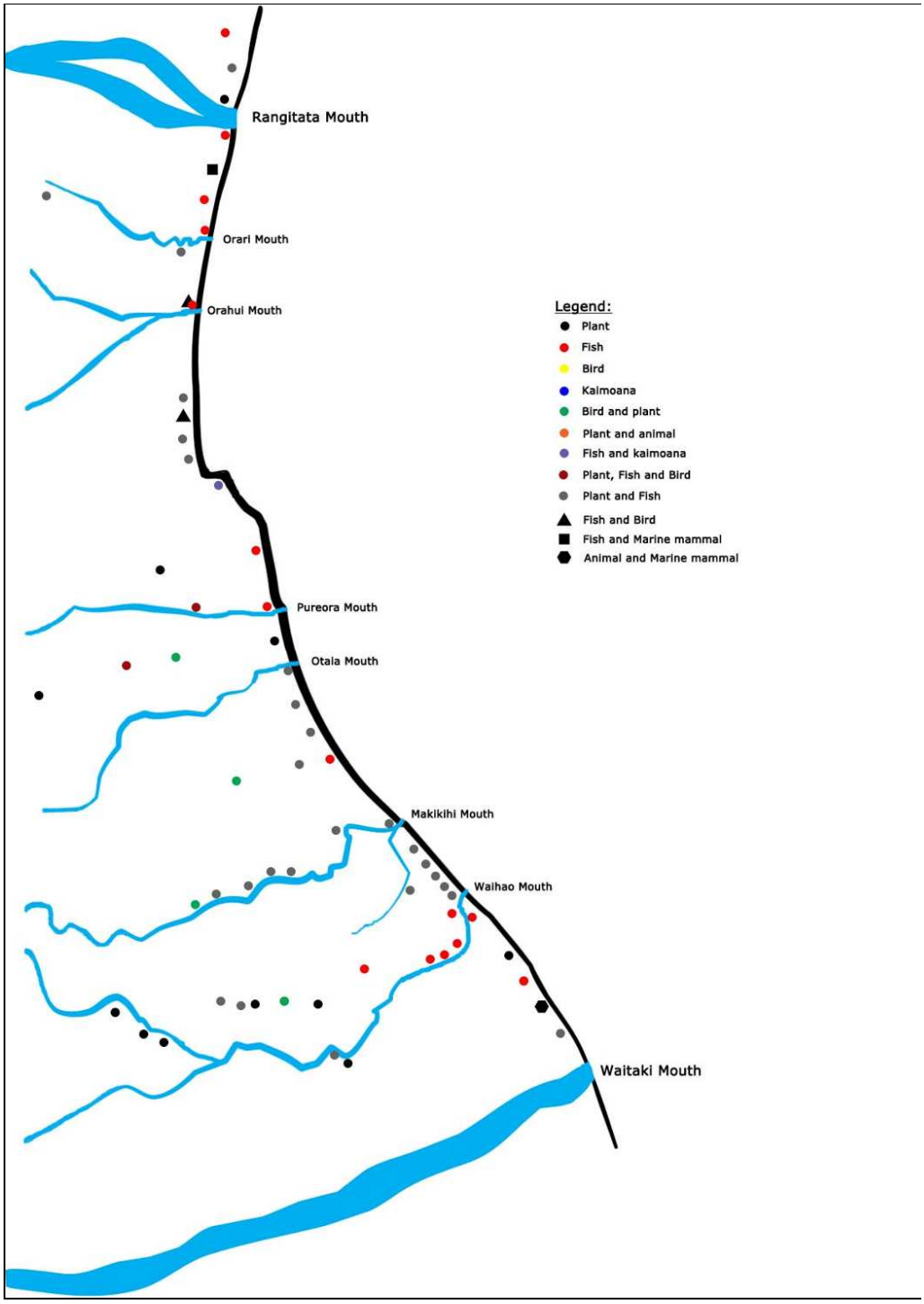


Figure 5: A few of the mahinga kai sites found across South Canterbury. (Please note that there were considerably more sites than those shown above. To avoid congestion of the map and to preserve the location of some sites, the names and uses of sites have been withheld).

As Table 2 shows, thirty eight different foods and materials were gathered from more than 100 sites across South Canterbury (between the Waitaki and the Rakaia and extending inland to the main divide). Table 3 shows the ten most commonly gathered species.

Table 3: Percentage of sites from which species were gathered from across South Canterbury.

SPECIES	PERCENTAGE OF
Eels	72%
Kauru (extract from the cabbage tree)	24%
Minnows	19%
Aruhe (bracken fern)	19%
Turnip / potato	13%
Whitebait	11%
Flax	11%
Koareare (root of the bulrush)	9%
Weka	8%
Kokopu / kokopara	8%

A distinctive social order emerged in the south shaped by the colder climate that dictated an itinerant lifestyle. Each whanau and hapu had rights to particular river reaches for fishing and defined lands for gathering wildlife and plants (Williams 2004, Anderson 1998). These areas were known as *rauiri* (preserves) and defined by *wakawaka* (boundaries) (Beattie 1939, Best 1942). It must be acknowledged however that traditionally rights had to be maintained through continual usage. Through an annual cycle of fishing, gathering and hunting, whanau and hapu "kept the fires burning" in many locations across a large tract of the South Island. Intermarriage between hapu and subsequent rights of inheritance and succession mean that for many Ngai Tahu today they now hold rights to lands across much of the southern region.

Historically enough kai was gathered to feed the immediate and extended whanau with some remaining to donate or trade. Mahinga kai meant survival. Sharing with those unable to gather for themselves is a practical expression of *whanaungatanga*. Concepts of *tapu* and *noa* shaped a management system that limited the scale of gathering (Anderson 1998, Williams 2004), but mistakes would have undoubtedly led to waste, overexploitation, and the collapse of some food sources. Knowledge of such mistakes passed from generation to generation in the form of *tikanga* and *kawa* (correct protocols and practices) the function of which was to prevent a repeat (Williams 2004).

Mahinga kai was the basis of an economy based "principally on the giving of gifts upon which were attached the obligations of reciprocity" (Williams 2004,p 88). By the time of European settlement Ngai Tahu had built a robust economy and a rich culture adapted to the local climate, resource base, and landscape (Evison 1993). Gathering was a social activity as well as an economic one. The extensive network of rivers, lakes, mountain ridges and valleys provided avenues of travel essential to Ngai Tahu social and economic relations. South Canterbury, in the middle of Te Wai Pounamu, provided links to the inland areas of the Mackenzie Valley, to the Upper Clutha and to Te Tai Poutini. Hapu and inter-hapu ties and alliances, the backbone of Ngai Tahu social and economic exchange systems, depended upon the free and easy movement of people within and beyond South Canterbury.

5.1.2 Post-European Settlement: Reserves and fishing easements awarded in 1848 and 1868

> *"Even after the land purchases, Ngai Tahu continued to gather their traditional food, not only from areas near their settlements but also in journeys to far places. Despite the development of pastoral farming by the new settlers many Ngai Tahu continued to rely on their traditional hunting grounds for their existence".* (Waitangi Tribunal 1991)

With promises of government payments for the purchase of lands, the retention of fishing and hunting rights, and allocation of a series of reserves, Ngai Tahu were persuaded to surrender title to significant tracts of land and the pattern of rauiri and wakawaka was disrupted. According to the Government's policy of setting aside reserves, small tracts of land were identified as reserves to protect Ngai Tahu from settlers. In practical terms however reserves enabled all lands beyond the boundaries of reserves to be opened for settlement.

Many of the reserves and fishing easements (listed in Tables 4 and 5 that were granted to enable the continuation of a food gathering lifestyle) can be traced back to Crown Grants to Ngai Tahu whanui which stem from the Southern Purchase Deeds negotiated between 1844 and 1857. As an unanticipated consequence of the sale and transition to newly acquired reserves, Ngai Tahu were no longer free to migrate seasonally across the plains of Canterbury.

As the lands along lowland catchments of South Canterbury were taken over by settlers, fences curtailed gathering of kai from many valued sites. Although Ngai Tahu were determined to maintain their relationship with mahinga kai, this period of land alienation and substitution with reserves and easements marked the initial transition from a traditional diet and a lifestyle dictated by resource utilisation.

Table 4: A list of some of the native reserves in the province of Canterbury (Mackay, undated).

Reserve Name	Acres	Interest
Section 12,373 Waikawa	150	
Kaikanui	4	Reserved in 1848 by Mantell in terms of Kemps Purchase
Arowhenua	376	Reserved in 1848 by Mantell in terms of Kemps Purchase
Waipopo	187	Reserved in 1848 by Mantell in terms of Kemps Purchase
Te Upoko o Rakaitaweka	20	Reserved in 1848 by Mantell in terms of Kemps Purchase
Tauhinu	23	Reserved in 1848 by Mantell in terms of Kemps Purchase
Waimatemate	40	Reserved by the Canterbury Association
Waikawa	138	Selected in lieu of reserve at Hakataramea
Rakipaua	20	Reserved in 1848 by Mantell in terms of Kemps Purchase
Arowhenua	2	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Arowhenua	150	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Arowhenua	30	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Arowhenua	20	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Waimatemate	500	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Waimatemate	30	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Waimatemate	10	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Waimatemate	20	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Taumutu	63	Reserved by the Governor General to supplement land at Taumutu
Kapunatiki	600	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Orari River (north)	10	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Orari River (south)	20	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Waitangi	10	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848

Because this research focuses on aquatic ecosystems, Table 5 extracts from Table 4 the reserves relating to the Fenton Orders of 1868 and highlights their relationship to

aquatic ecosystems. These reserves and easements are important as even today they continue to sustain the gathering of freshwater aquatic species. However access to and the ability to gather many of the terrestrial species listed in Table 1 was denied from the mid nineteenth century.

Table 5: A Summary of Fenton Orders of 1868 resulting from Kemps Deed of 1848[6].

Location	Association with water
450 acres Waitangi District (Waihao Maori Reserve)	
30 acres District (Glenavy sections)	
10 acres Waitangi District – near Wainono (Te Houiri Maori reserve)	Fishing easement - Near Wainono Lagoon. Bounded on the westward by a small lagoon.
20 acres Waitangi District (Puhakati Maori Reserve)	Fishing easement
10 acres Waitangi District Awakokomuka Maori Reserve	Fishing easement (now inaccessible)
600 acres Timaru District – Kapunatiki	The southern boundary skirting the edge of the swamp
10 acres Timaru District – south bank Orari River	Fishing easement - Having 10 chains frontage to the south bank of the river
20 acres Timaru District – north bank Orari River	Fishing easement - Having 10 chains frontage to the north bank of the river (has now disappeared)
2 acres	Fishing easement - A square block of land from the stream from Waitarakao Lagoon (near Washdyke)
150 acres Timaru District – Kapunatiki Creek	Is now gone – disappeared.
72 acres	Part of island near Harereatou Lagoon in the mouth of the Umukaha River – this is now washed away.
20 acres Timaru District – Orakipaoa (to include old pa)	

Figure 6 illustrates the location of the fishing easements in Canterbury, including the five in the Arowhenua district which are highlighted.

[6] This information was sourced from Taylor (1950) and from descriptions found in a report titled *Research into Maori Fishing Reserves: Establishment of Rights – Objections and Complaints from 1840"*. The senior author was given a copy of the report by Kelly Davis.

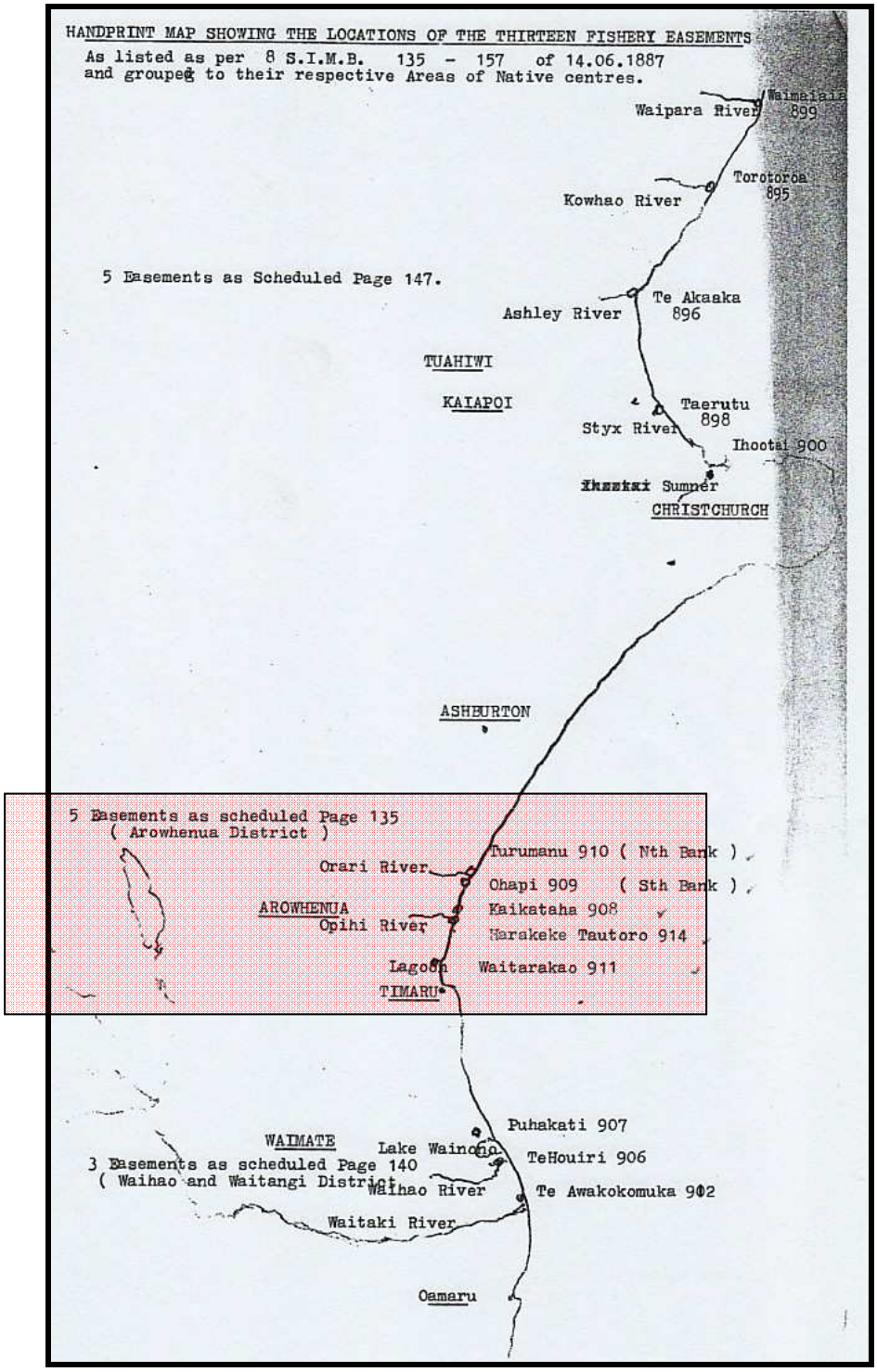


Figure 6: Location of fishing easements in Canterbury.

Figure 7: Coastline near Timaru – September 1874 (Australian National Library).

Figure 8: Washdyke Lagoon – near Timaru, October 1874. Thirty acres of this has now gone (Australian National Library).

Figure 9: Washdyke Lagoon 1874 (Australian National Library).

5.1.3 Comments presented in support of the Ngai Tahu Claim to the Waitangi Tribunal in 1989 – 1990.

Members of Te Runanga o Arowhenua presented evidence to the Waitangi Tribunal in 1989-90 in support of the Ngai Tahu Claim (Wai 27). They explained how all the lakes and rivers in the South Canterbury area that were once a source of food had been modified and adversely impacted since European settlement. These statements to the Tribunal provide insights into the changing mahinga kai practices experienced by whanau living across South Canterbury, and importantly with respect to this research, identify emerging contamination concerns.

Kai gathering

- Mr Jack Reihana recalled camping for a week or more to catch and preserve eels at Lake Wainono and spoke of an old lady bringing home large quantities of dried eels from Waitarokaoa (Washdyke) (WT 1991, H10:2).

- Mr William Torepe reviewed past and [then] present availability of mahinga kai from Waitaki to Rakaia (H10:4) which included kai such as tuna, fish, watercress, wild fowl and acclimatised species in the Opihi, Waihi and Temuka Rivers, Milford Lagoon, Hae Hae Te Moana, Kakahu, the beach in the vicinity of Pareora River, and Waimate Creek. He then proceeded to comment on the "diminution of Maori kai" and how this has affected their ability to manaaki guests on the marae (WT 1991, H10:8).

- Mr Kelvin Anglem spoke of the past abundance of eels in the Opihi which were preserved or bartered. He also commented on the [then] depletion of tuna, whitebait and kanakana (WT 1991, H10:19). He lamented the shortage of eels in the Opihi River which once supplied in one night their whole winter's supply.

- Mr Kelvyn Davis-Te Maire stressed that the areas were not merely important for mahinga kai but were also areas of historical importance (WT 1991, H10:33–34).

- Te Ao Hurae Waaka, related the past history of the district and how the whole area from the eastern seashore to the main divide had been accessed by Arowhenua (WT 1991, H10:47; H47.1).

The impacts associated with introducing exotic species

Although Ngai Tahu had repeatedly voiced their concerns at the impact of introduced aquatic species, the general consensus of those presenting scientific evidence to the Tribunal was that the decline in native species was due to changing land use rather than from competition with exotic fish. Mr Davis-Te Maire was critical of the management of water fowl by the Acclimatisation Society (now restructured as the Fish and Game Council) (WT 1991, H10:33). Mr Anglem described eel drives designed to protect young trout, when hundreds of eels were slashed and killed with lengths of hoop iron and allowed to flood down the river or left to rot on the banks (WT 1991, H10:23).

Water extraction

Mr Torepe spoke of the lack of water in the Opihi River - an important mahinga kai location (WT 1991, H10:2). He attributed this to the issuance of permits by the Regional Water Board to allow the Timaru City Council to draw off water for domestic supply and permits for farmers to take water for irrigation. He observed that this had the effect of reducing flows in the lower Opihi River, leaving it dry for at least three months of the summer with the consequent effect on kai resources. He claimed that the majority of streams and creeks within Canterbury had been transformed into flood channels. He believed the supply of fish in the Opihi River was now depleted as a result of water reduction.

The Opihi River has been affected by flow reductions since about 1936, when the Levels Plain Irrigation Scheme began operation. These reductions created a number of problems for fish stocks.

- Compounding the impact of low flows, another witness, Mr Sagar, contended that changes in land use within the catchment, and flood protection works had all contributed to modifying the river system.

- Mr Little stated that not only does water extraction lead to a loss of fisheries habitat, migration routes and cover, it also results in changes in temperature, increased weed growth and possibly destruction of the river (WT 1991, P15a:10).

It was thought that modest increases in the flow of the Opihi would improve the fisheries values of the river. A minimum was instituted following commissioning of the Opuha Irrigation Scheme. Although dewatering is not longer a problem, a number of issues persist.

The demands for water from so many uses, coupled with river re-alignment, plus land loss when floods washed away acres of reserve land, and the drainage of creeks and swamps, all served to adversely affect Ngai Tahu's access to mahinga kai. It also contributed to another serious consequence – the problem of pollution.

Pollution

Mr Anglem identified factors such as sewerage disposal, wool scour effluent, dairy factory discharge, aerial spraying and topdressing, farm waste and irrigation diversion which had reduced the Opihi and its estuary from an important breeding and feeding ground for migratory birds and fish into something unfit for humans and animals to swim in, concluding:

> *I am glad my Tupuna cannot stand on the banks of the Opihi and see what I have stood back and allowed to happen to their river.* (WT 1991, H10:24)

Mr Torepe (17.2.5) said that dirty and greasy effluent was discharged into the Waihi River at Winchester (WT 1991, H10:2). He also added that the beach in the vicinity of the Pareora River may be polluted by freezing works discharge of untreated remains (see Figure 10 below).

Figure 10: Opened in 1904, the Pareora Freezing Works is one of two meat-processing plants in the region – Smithfield at Washdyke is the other. The red hue in the sea is effluent from the works. (Photo source: www.teara.govt.nz/files/p11486gns.jpg).

A report from the water resources manager of the South Canterbury Regional Water Board (WT 1991, H49) dated 8 April 1988, describes the water quality in the Waihou River, Lake Wainono, Opihi River, Temuka River, Orari River, Rangitata River and the coastal zone. The problem of eutrophication within the Waihi–Temuka River system and the lower Orari River was highlighted. The report explained that eutrophication results mainly from the introduction of nitrogen and phosphorus. Fertiliser on farmland was seen as the major source of nitrogen. Domestic sewerage was believed to be the major source of phosphorous which it was thought could be addressed by upgrading the oxidation ponds at the Geraldine and Temuka treatment plants.

The witnesses to the Waitangi Tribunal concluded that there were serious water quality problems in the Temuka River and indeed they predicted problems in other rivers in the future. The members of the Waitangi Tribunal concluded after viewing the lower Opihi River that diverse sources of nutrients from adjacent farmland and the shortage of water in the river generally have changed the structure of the river with a serious effect on the mahinga kai qualities.

Without doubt, social and economic shifts during the last 160 years resulted in major changes in the relationship between Ngai Tahu and mahinga kai. The cumulative effect of settlement, an industrial economy that saw newly arrived settlers exploit all economic resources, plus the plethora of regulatory systems instituted by government, changed both the circumstances and practice of mahinga kai, with both natural environments and resources impacted, and consequently the knowledge generating processes associated with kai gathering being changed or alienated from many Ngai Tahu.

5.2 Contemporary patterns of gathering

This section draws on the data from the Kai Consumption Survey to describe contemporary kai gathering practices and behaviours. Where appropriate quotations extracted from the interviews with whanau members are added.

5.2.1 Background of participants

All participants were Maori residing in the South Canterbury region.

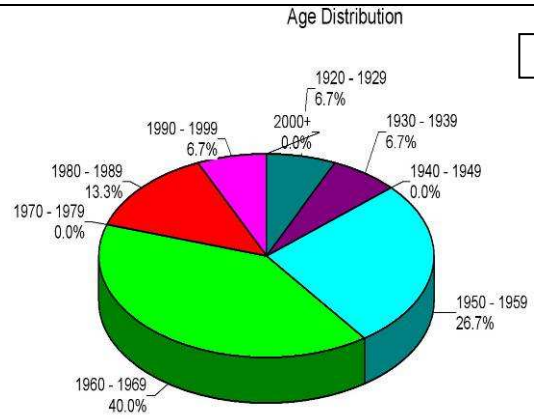


Figure 11

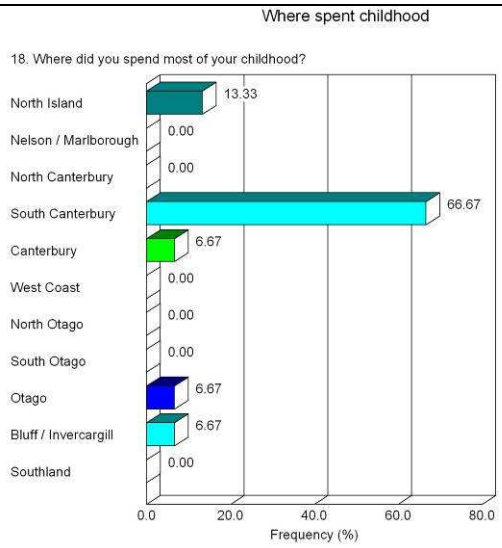


Figure 12

Only a limited number of participants have completed the survey (Figure 11):

- 1 is aged 10-19 years
- 2 are aged 20-29 years
- 6 are aged 40-49 years
- 4 are aged 50-59 years
- 1 was aged 70-79 years
- 1 was aged 80-89 years

Of the 15 participants 2 were female and 13 were male.

Two thirds of the participants spent their childhood in South Canterbury (within the takiwa of Te Runanga o Arowhenua) while two of the participants grew up in the North Island (Figure 12).

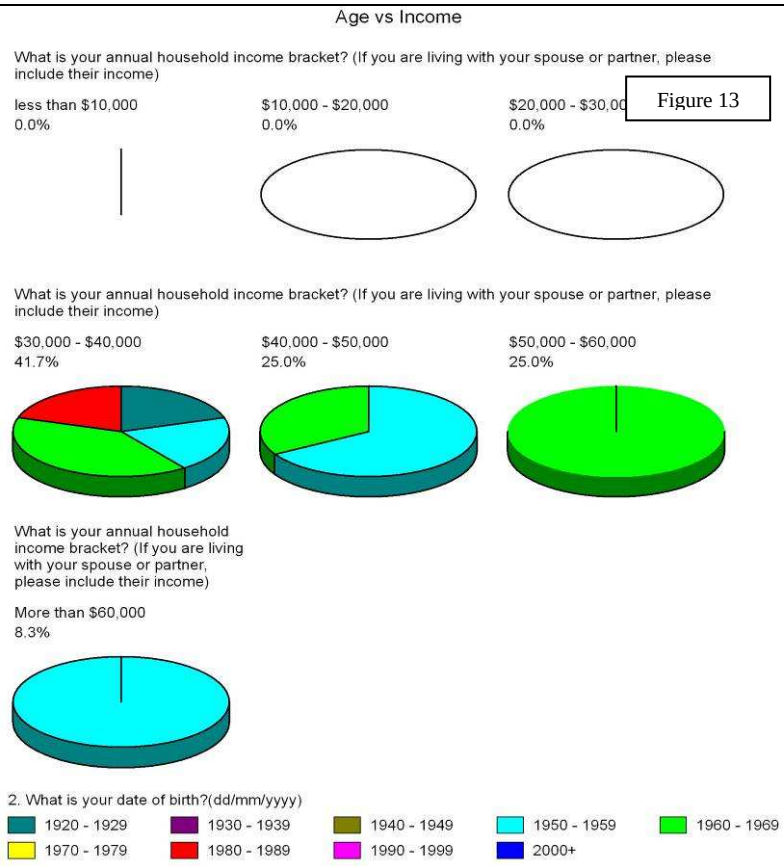


Figure 13

With respect to income (Figure 13)

- 41.7% received between $30,000-$40,000 – which was the lowest recorded.
- 25% earned between $40,000-$50,000.
- 25% earned between $50,000-$60,000.

The data relating to income, as shown in Figure 13, can be compared to data collected from the 2006 census when:

- 44 percent of Ngai Tahu reported an annual personal income of $20,000 or less, while 6 percent received over $70,000.
- The median annual income (half receive more, and half receive less, than this amount) for Ngai Tahu was $23,400 in 2006. In comparison, the median annual income was $21,900 for the total population of Maori descent, and $24,400 for the total New Zealand population.
- The median annual income was $30,200 for Ngai Tahu men and $19,200 for women.

5.2.2 Patterns of kai consumption

The principal purpose of the Kai Consumption Survey was to determine the extent of gathering by whanau living in South Canterbury. The range of species that are consumed are listed in Table 6.

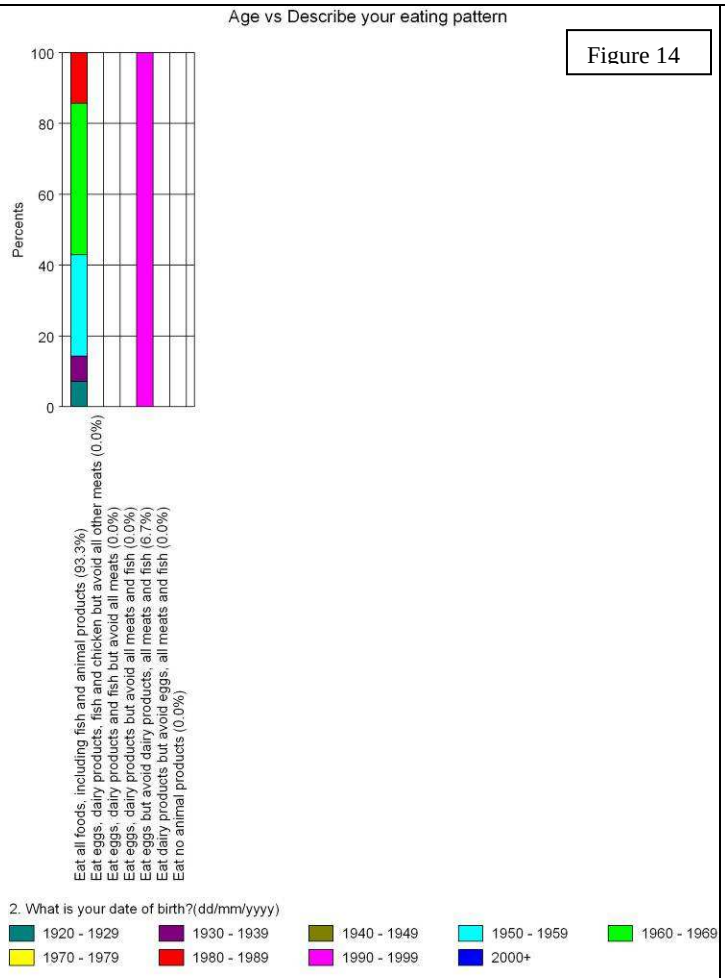
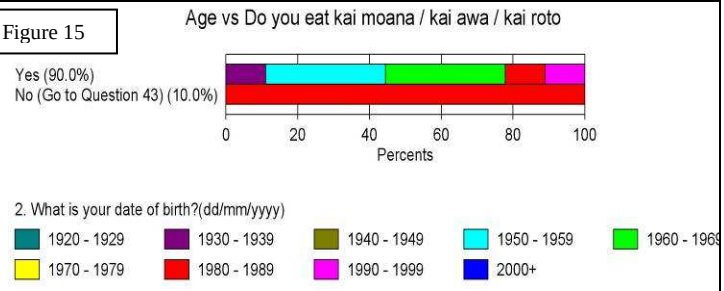


Figure 14

The majority of participants (93%) eat all foods, including fish, meat and all dairy products (Figure 14).

The exception was the tamariki who avoids dairy products, meats and fish.

Figure 15



90% of participants across all age groups eat kai moana, kai awa or kai roto (Figure 15). Only 10% (all aged between 20-29 years) do not eat kai moana, kai awa and kai roto.

Table 6: A comparison of foods historically sourced from sites in South Canterbury compared to foods gathered and consumed today.

KAI (**GATHERED** HISTORICALLY)	KAI (**GATHERED** TODAY)	KAI (**CONSUMED** TODAY)
		Butterfish
		Freshwater mussels
		Morihana
	Herrings	Herrings
		Pipi
		Cockles
		Toheroa
		Tuatua
		Greenbone
Kanakana	Lampreys	Lampreys
		Mutton birds
Eels	Eel	Eel
Flounder, Pakihi	Flounder	Flounder
Groper		Hapuka
Mullet	Mullet	Mullet
Kahawai	Kahawai	Kahawai
		Kingfish
		Gurnard
		Snapper
		Moki
Shark	Shark	Shark
		Tarakihi
		Trevally
Whitebait, Smelt, Minnows, Kokopara, Kokopu, Patete	Whitebait	Whitebait
	Trout	Trout
Sea urchins	Kina	Kina
Paua	Paua	Paua
	Mussels	Mussels
	Crayfish	Crayfish
	Oysters	Oysters
		Pupu
	Seaweed	Seaweed
		Freshwater crayfish
Watercress	Watercress	Watercress
Puha	Puha	Puha
Potato, turnip, cabbage		
Flax, flax honey		
Seals		
Aruhe		
Rats		
Koareare		
Sea nuts		
Whale		
Kauru		
Kumara		
Tutu		
Panako		
Weka		
Birds		
Taramea		
Shellfish		

Only 11 of the list of species gathered historically (as listed in Table 3) are still gathered and consumed today. These are highlighted in Table 6.

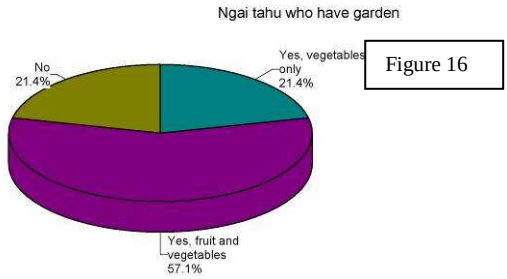


Figure 16

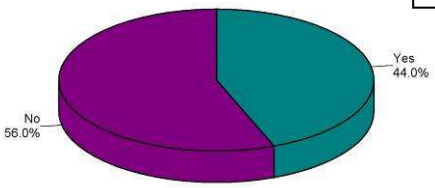
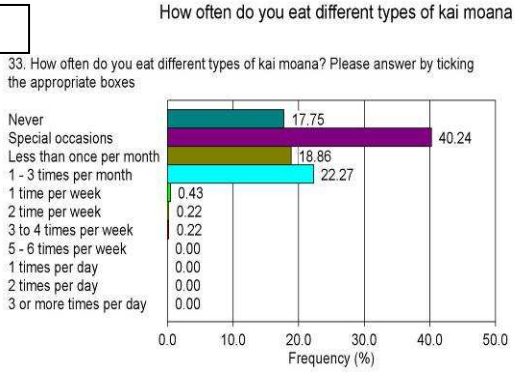


Figure 17

Figure 18



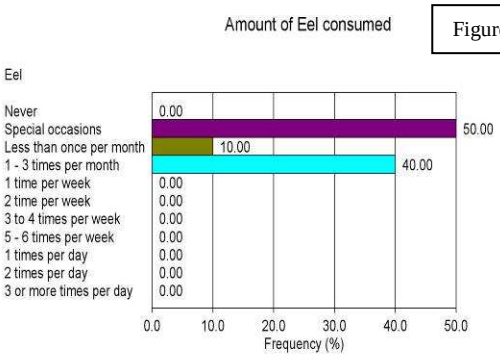


Figure 19

Consistent with the itinerant kai gathering lifestyle of their tupuna.

- 44% of respondents hunted, while
- 78.5% grew their own vegetables.
- Of the 78.5%, 57% of those who grew vegetables also grew fruit (Figures 16 and 17).
- The data also showed how after the introduction of potatoes and turnips by settlers, Ngai Tahu were quick to establish cultivations. However that was still combined with aspects of their itinerant lifestyle by resting lands and returning to use after being left for a period to recover.
- There is also a community garden and glass house at the marae.

Having determined that 90% of respondents do consume different types of kai:

- 40% of respondents said they now only eat kai on special occasions; while
- 18.9% eat kai less than once a month; and
- 22.3% only eat kai 1-3 times per month (Figure 18).

Figures 19 - 24 illustrate how often the various species are consumed:

- 40% of those eating eel have this food 1-3 times per month.
- It was of concern therefore that 70% of the respondents believed that there were now “a lot fewer” eels present.

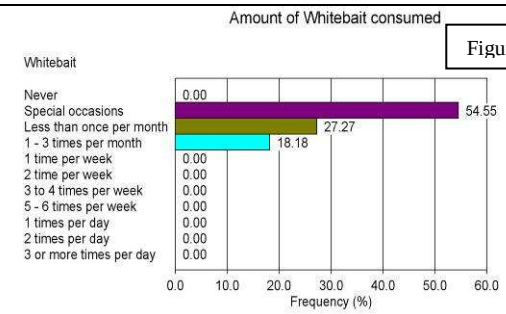


Figure 20

- For paua, whitebait, eel, flounder and crayfish at least 50% of the respondents indicate they consume these species at special occasions.

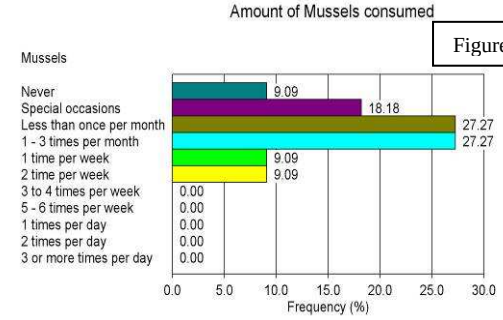


Figure 21

- Only mussels are consumed weekly – specifically once or twice per week. Interesting this is the only species that some respondents believed had increased in abundance.
- They also observed that mussels can now be easily accessed from supermarkets.

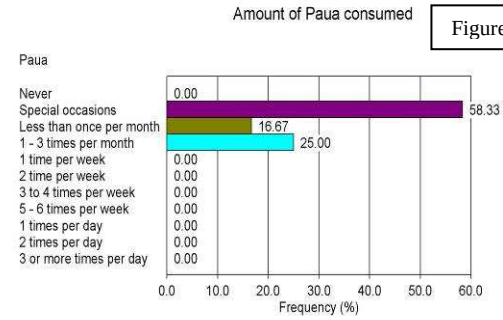


Figure 22

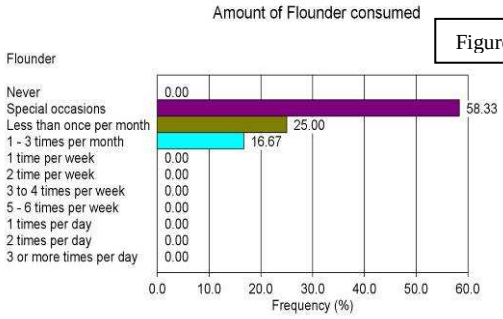


Figure 23

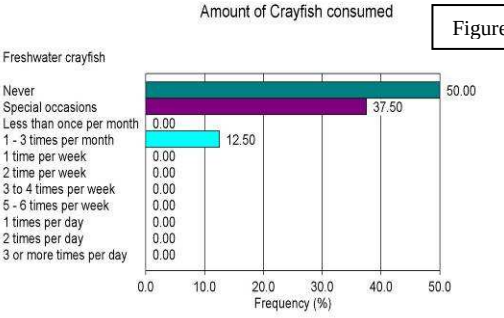


Figure 24

How respondents prepared their kai was also important. It was accepted that although many would prepare their own kai, others would purchase fish at take always, and supermarkets (as either fresh or tinned fish). Figures 25-27 illustrate the difference between age groups.

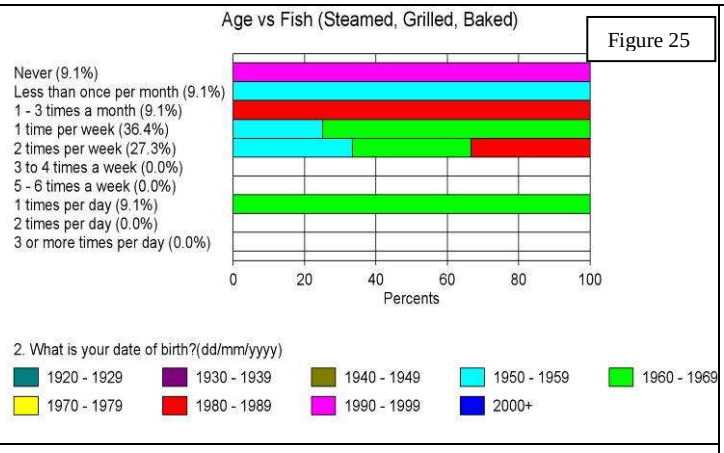


Figure 25

63.7% of respondents consumed steamed, grilled or baked fish at least 1 per week.

Today convenience foods can be purchased from a variety of sources and is available:

- As tinned fish;
- As fresh fish available in the deli of a supermarket; and
- As fish and chips at a take way store.

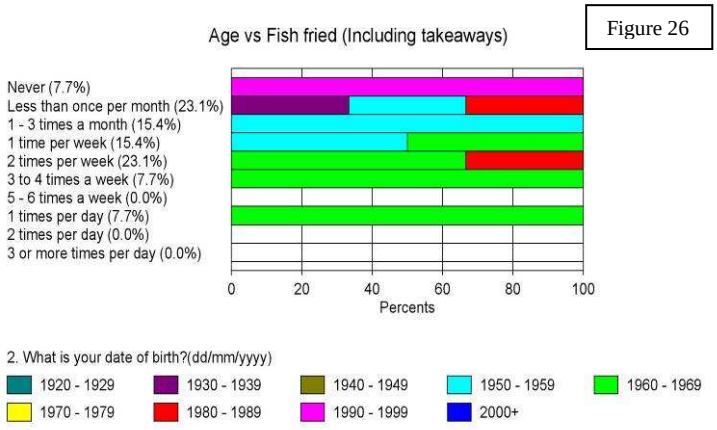


Figure 26

The graphs at left confirm that:

- Fried fish is consumed frequently and by one respondent at least once per day.
- 46.2% buy fried fish at least once a week.

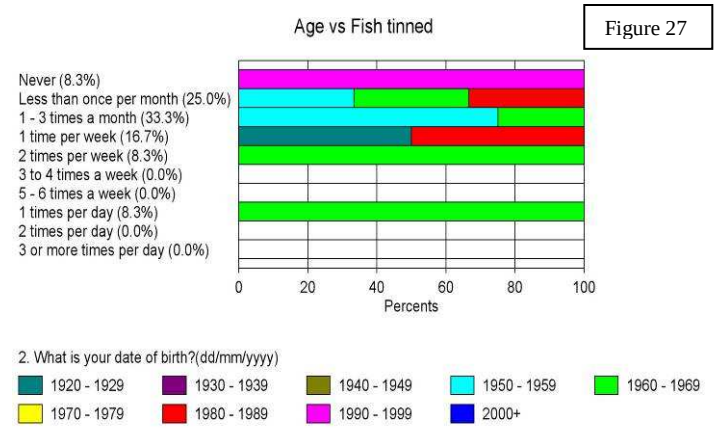


Figure 27

Interestingly Kaumatua consume fried fish less than once per month although in contrast they consume tin fish at least once a week.

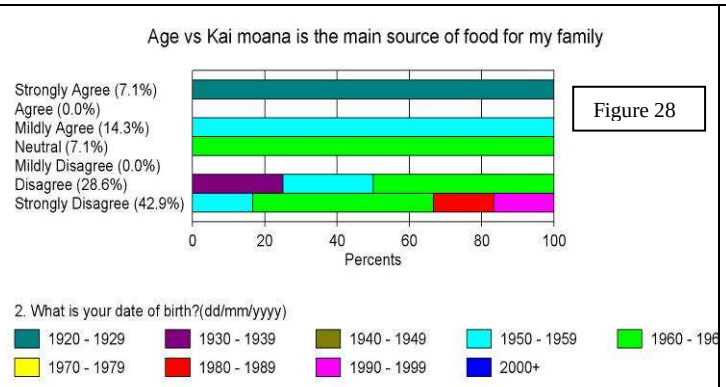


Figure 28

We wanted to determine how dependent whanau were on kaimoana. A question therefore asked if kai moana was the main source of food for the whanau.

- The oldest Kaumatua participating was the only one that strongly agreed with this statement.
- The others that agreed with this statement were aged 50-59 years. In contrast the rangatahi and tamariki participating all strongly disagreed with this statement. In fact 71% spread across four age groups disagreed or strongly disagreed – in other words kai was not the main source of food for their family.

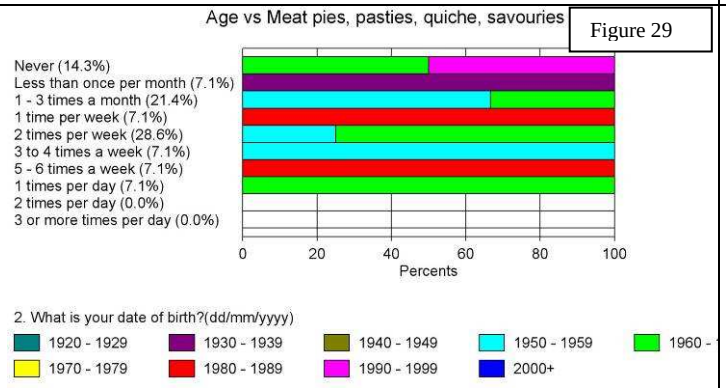


Figure 29

- Questions sought to identify changes from a traditional diet to a western style diet (Figure 29). It was of concern that 57% of respondents eat meat pies, pasties, quiche or savouries at least weekly, with 28% eating these foods twice a week and one participant eating these foods daily.

5.2.3 Estimates of the quantity of kai consumed

This research investigates the risk of contamination from eating wild sourced kai. A key consideration is the amount of kai that they are actually consuming. This is calculated by examining:

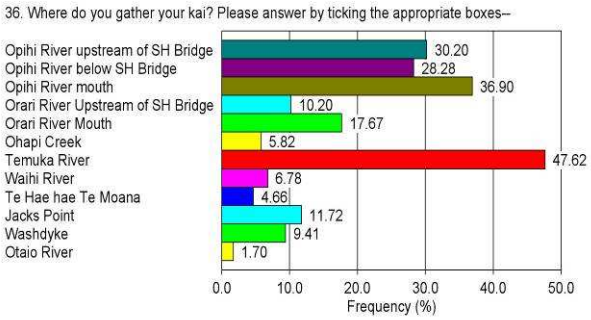
- the frequency or number of times they consume kai; and
- the quantity per sitting.

63.7% of respondents consumed steamed, grilled or baked fish at least 1 per week. From the data collected we also know that they consumed approximately 230.77 of fish per sitting. For mussels and whitebait the quantities change somewhat with participants consuming 157g and 302g per sitting.

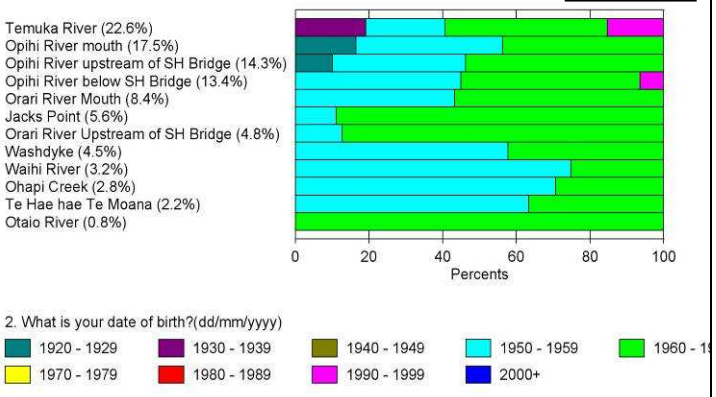
5.2.4 Sites at which kai gathering and other activities are undertaken

In addition to identifying the species gathered, the sites from which kai was sourced were identified. These sites were used as the basis for a sampling programme which examined contaminants in sediment and kai species (see Appendix 2 for site details). Figure 30 below confirms that 47.6% of participants gather from the Temuka River, while the Opihi River (upstream of State Highway 1, downstream of the State Highway, and the river mouth) are used by 30%, 28% and 37% of participants, respectively.

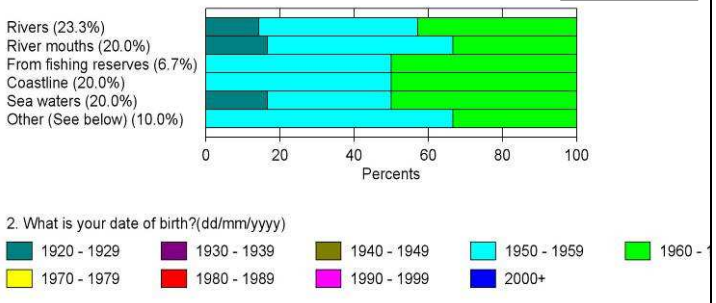
Where do you gather your kai — Figure 30



Age vs Where do you gather kai — Figure 31



Age vs Locations you gathered kai from — Figure 32



Of the sites listed in the Figures at left (Figure 30):

- There is easy access to the Opihi River and reserves at the river mouth.
- There are fishing easements on the south bank of the Orari River mouth and at Ohapi Creek.
- There is a reserve at Washdyke.

From the data collected it is also possible to identify the gathering preferences of the respective age groups (Figure 31):

- Kaumatua and tamariki fish locally from the Opihi and Temuka Rivers.
- Pakeke are the most mobile with those aged between 40-59 accessing most sites.

When identifying the reaches of a river that are fished by the respective age groups (Figure 32):

- Pakeke are the most mobile accessing most river types.
- Kaumatua limited their gathering to river mouths and coastal fishing.
- Only 6% fished from the reserves.

Figures 33 and 34 the various species that are sourced from the different waterbodies and the relative proportions of each species gathered.

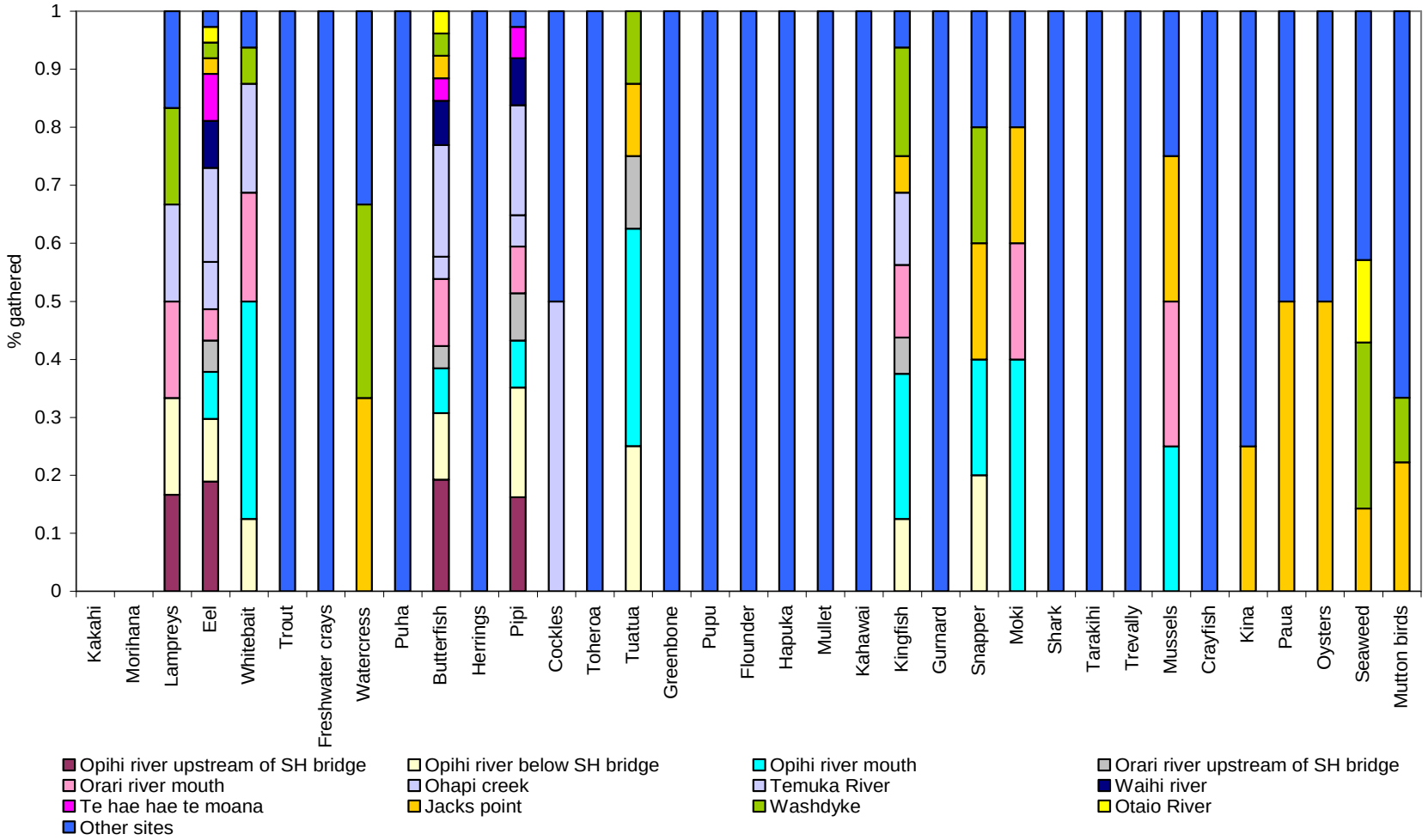


Figure 33: Relative proportions of sites from which the different species of kai were gathered.

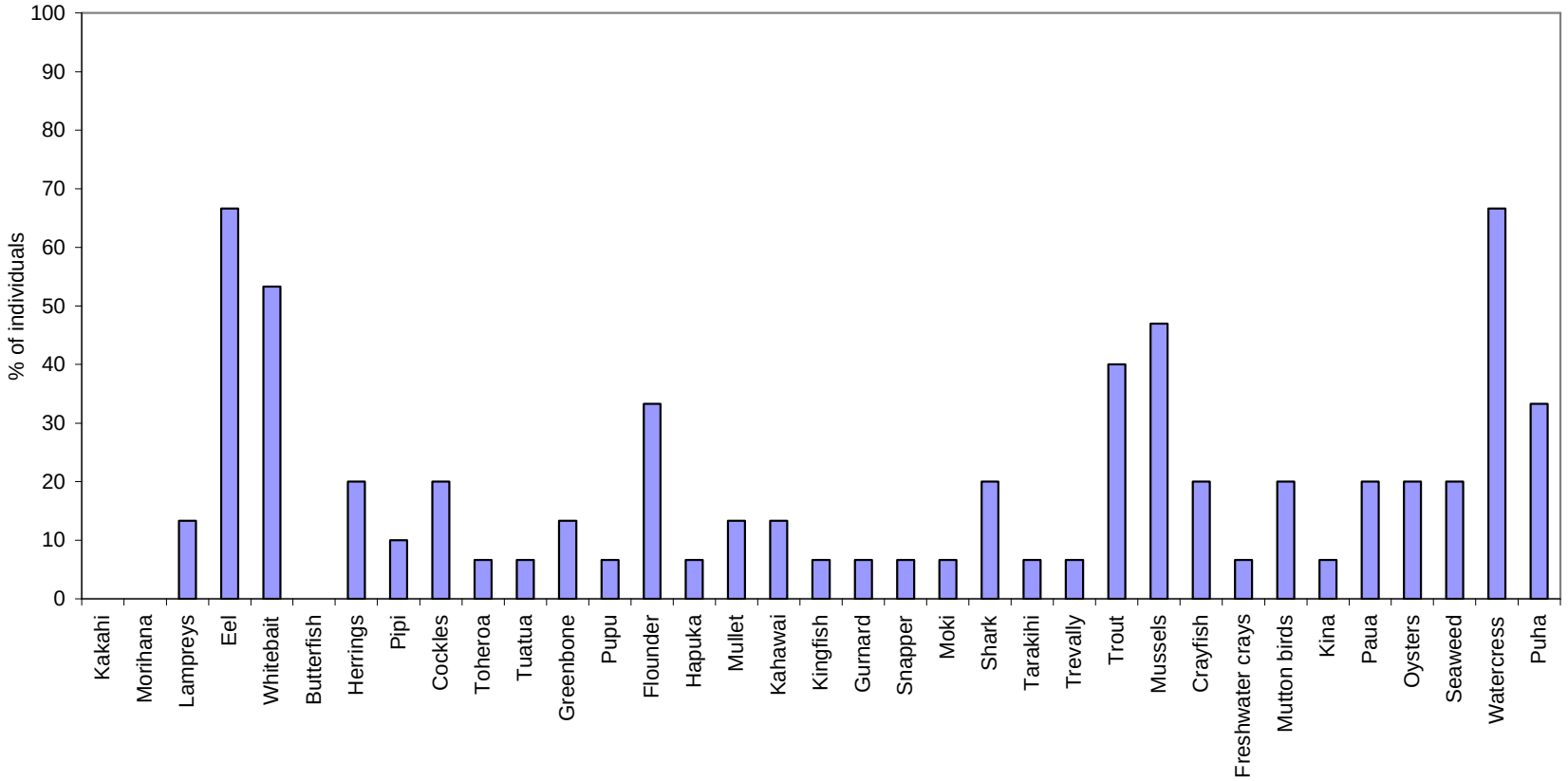


Figure 34: Percentage of individuals that gather different kai species.

In addition to gathering data about kai, data were collected about other activities undertaken at the respective sites, as contact with these waters could be a source of exposure to contaminants, rather than kai consumption. Figures 35-44 illustrate these additional activities. In summary:

- Swimming at some sites reflects their perceived high water quality.

- The two sites on the Opihi, in proximity to the State Highway Bridge, are popular for swimming with all respondents who use these sites.

- These two sites on the Opihi plus the Temuka also supported the greatest range of activities by whanau.

- The Temuka River and the Te Hae Hae Moana River are also swimming spots – again all respondents using these sites say they swim there.

- Sites that are known to be adversely impacted by activities in the catchment (and thus suffering degraded water quality) received mixed levels of use:

    - Jacks Point supports a range of fishing related activities but limited swimming (only 25%).

    - Ohapi Creek, one of the fishing easements, is used solely for fishing.

    - Washdyke, one of the reserves, is used solely for fishing.

    - Opihi River Mouth supports a range of activities but only 40% of the respondents swim there.

    - Otaio does not support swimming.

Photos are included beside each figure to give a visual depiction of the site.

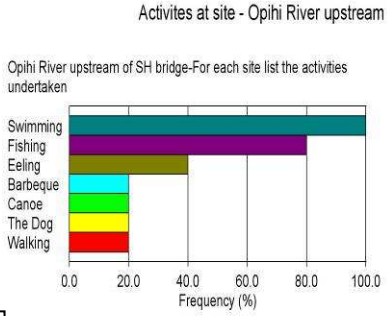
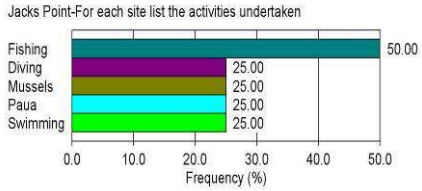


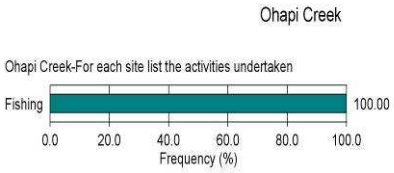
Figure 35

* Note: Multiple answer percentage-count totals not meaningful.



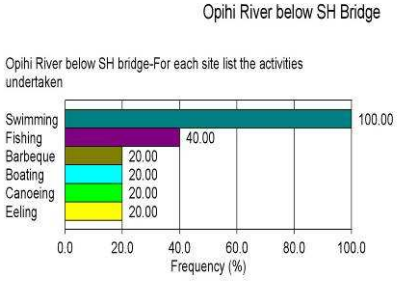
* Note: Multiple answer percentage-count totals not meaningful.

Figure 36



* Note: Multiple answer percentage-count totals not meaningful.

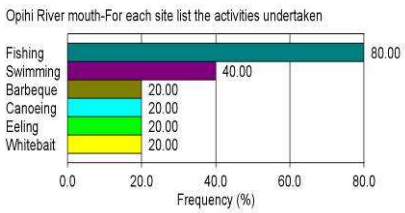
Figure 37



* Note: Multiple answer percentage-count totals not meaningful.

Figure 38

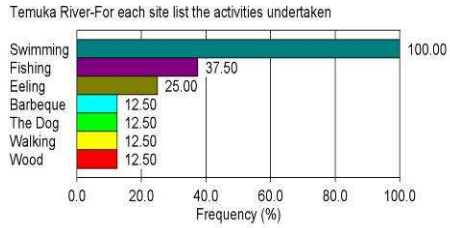
Opihi River mouth



* Note: Multiple answer percentage-count totals not meaningful.

Figure 39

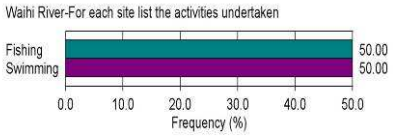
Temuka River



* Note: Multiple answer percentage-count totals not meaningful.

Figure 40

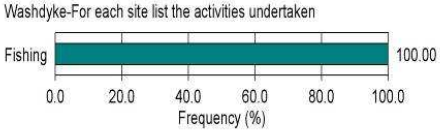
Waihi River



* Note: Multiple answer percentage-count totals not meaningful.

Figure 41

Washdyke



* Note: Multiple answer percentage-count totals not meaningful.

Figure 42

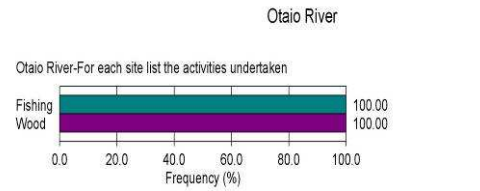


Figure 43

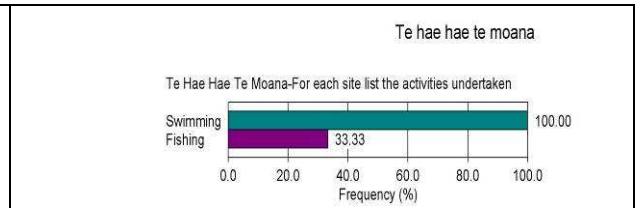


Figure 44

5.2.5 Other sources of kai

This project aims to assist the risk of exposure to contaminants associated with kai gathering. If there are concerns about the safety of kai consumed, and people are consuming kai that has been gifted, it is important to know where the kai comes from.

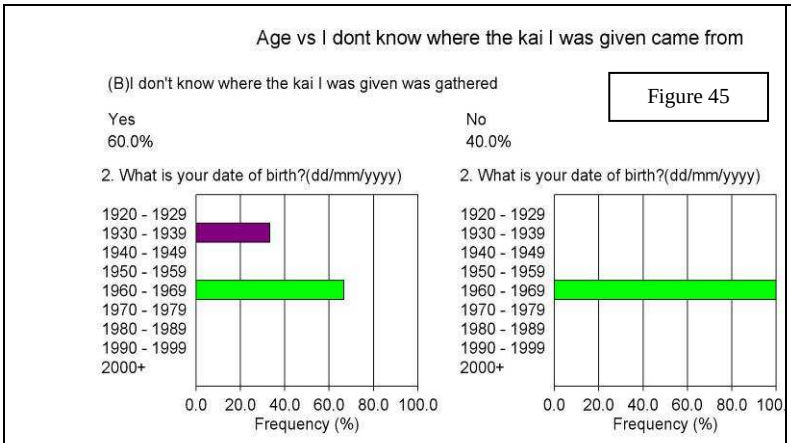


Figure 45

60% of respondents indicated that they did not know where the kai they were given was sourced.

Assuming the sites whanau gather from would change if the condition of the site was degraded; respondents were asked if they were able to gather from the sites that they have always gathered from.

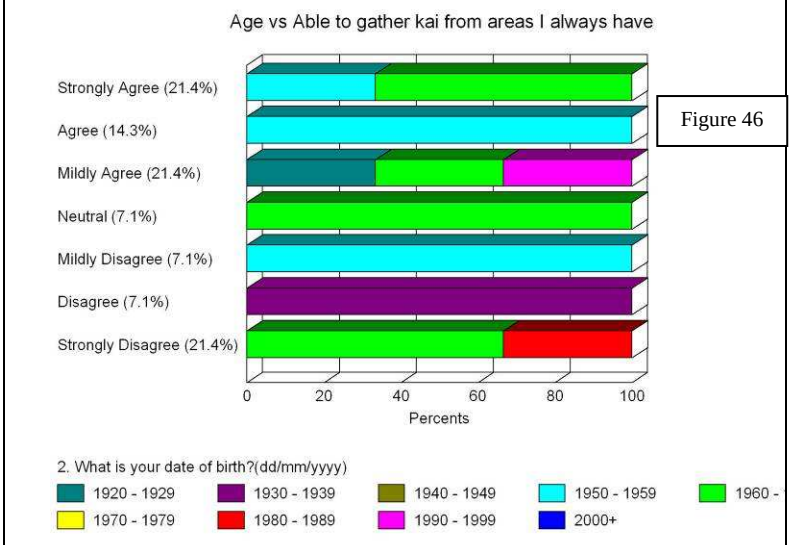


Figure 46

- 56% agree that they can.
- 35% say that they cannot.

No trends can be detected when looking at the respective age groups.

As whanau explained:

I still go there (Washdyke) on the sea side of it when it's (whitebait) in season and I still venture into the lagoon for kanakana.

We have gone as far Rangitata and Moeraki. With Moeraki always being used for paua and pupu which were gathered with Aunty and she would show us how to make kelp bag.

Paerora River was where they washed the bodies. I have just found out When we were younger we would go to the Waihao for kanakana and eels and we never touched the Paerora but I never knew why till now.

My favourite eeling spot is between the Temuka Road Bridge and the Manse Bridge and beyond. In that stretch of water when we were young we could catch around 50 eels and it was no hassle. You would see as many go past you as you spear but today in that same stretch of water you would see 5 eels that were not able to take.

Mainly around here I go to the Opihi. But lately in the last few years I wouldn't go floundering there because of the smell as the lagoon would get built up and water get stagnant and really bad smell. To me it goes to the fish and you couldn't eat it.

To Jacks Point for mussels. A lot of people gather around the wharf but I wouldn't because of all the oil and stuff that comes from the boats. I would go to Jacks Point where it's a lot cleaner.

The prime area being the Temuka and Opihi River and Awarua River (joined the Temuka straight across from the Marae). Awarua River was where we get a lot of watercress and we still do and freshwater koura. And tuna those were the basic ones we took from there.

5.2.6 Preferred kai species

Tuna was a major part of our diet. Most people didn't have the money to go out and buy food so they would use the awa as much as possible. They would go through the seasons from eeling in the summer through to March. Then move to kanakana in June / July / August in the colder parts of the season and whitebait as well. Then tuna would start to come back into season September onwards.

There was always kai around. If you couldn't get it in one place you would go to other places. If we didn't get paua here we would go down to Moeraki and if we couldn't get tuna here we would go somewhere else. It all depends on the time of year. We get patiki at certain times of year at spring time. There was always an abundance of food at that time but there was also a matter of storing it and preparing it so you could keep.

A question asked respondents to choose from the list of kaimoana, kai roto, or kai awa species those that they most preferred to eat. They were only allowed to choose their "top 6". These were to be their preferred kai.

- "1" was to be written beside their most preferred food;
- "2" was to written alongside their second choice;
- down to "6" which is to indicate their 6th preference.

Surprisingly, the top 6 preferences according to the ratings (in order of preference were):

5. snapper, koura
6. kina
7. trout
8. pupu, pipi, cockles, herrings, oysters.

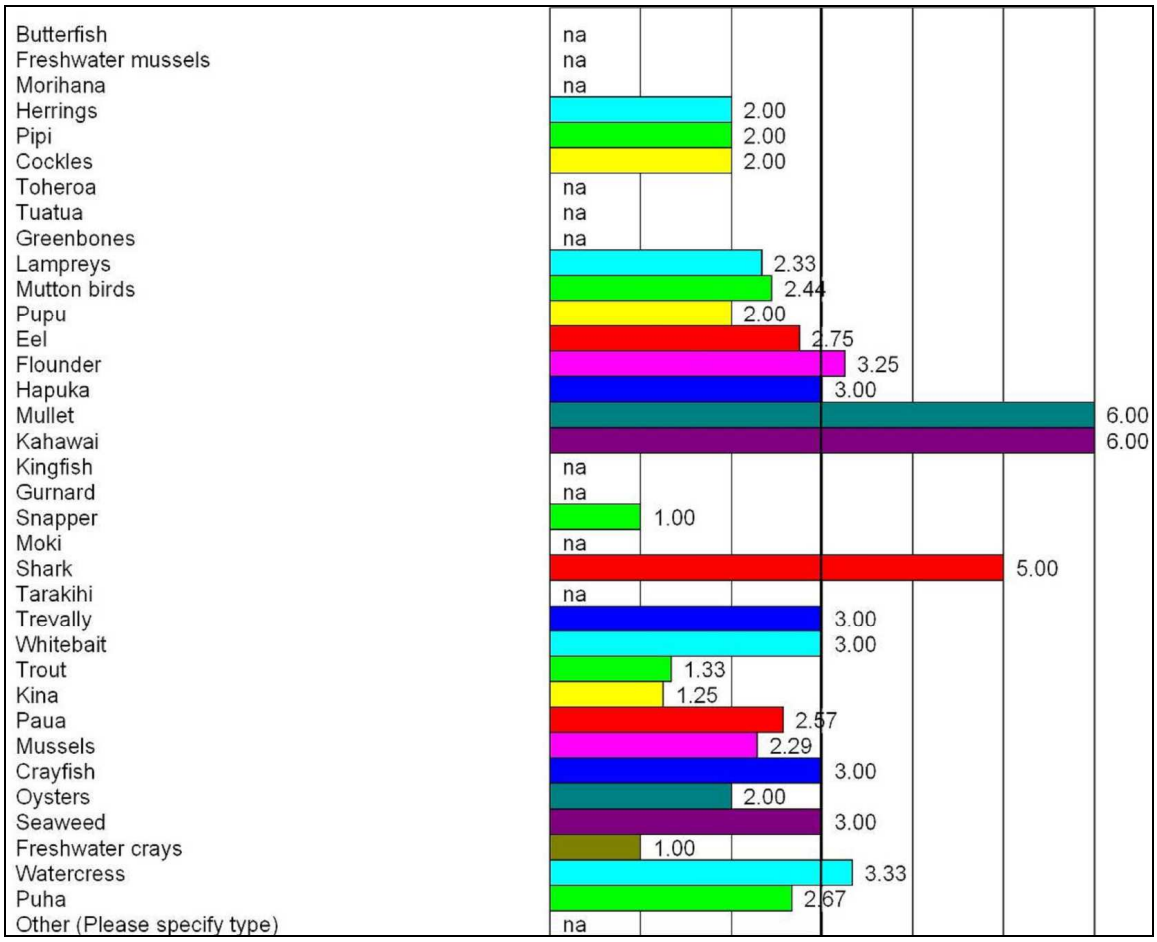
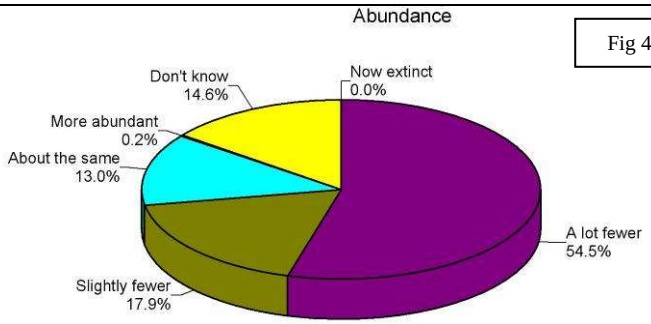


Figure 47: Preferred kai species (Numbers 0- 6 on the x axis represent the preference of whanau – 1 being the most preferred and 6 the lease preferred)

5.2.7 Perceived changes in the abundance of species that are gathered

If kai moana, kai awa and kai roto are to be promoted as a beneficial source of food for whanau, there need to be sufficient quantities of healthy stocks in order to sustain gathering. Questions in the Kai Consumption Survey asked whanau to provide their assessment of the stocks of various species gathered.



Of concern 54% of respondents believed that across all species gathered there were now a “lot fewer” available while another 17.9% believed that abundance was “slightly fewer”(Figure 47).

Table 8: Changes in the abundance of species (as a percentage)[7].

SPECIES	A LOT FEWER	SLIGHTLY FEWER	ABOUT THE SAME	MORE ABUNDANT
Butterfish	25	25	25	-
Kakahi	50	25	25	-
Morihana	33.3	33.3	-	-
Herrings	50	25	25	-
Cockles	37.5	37.5	-	-
Pipi	40	20	-	-
Toheroa	50	25	-	-
Tuatua	33	33	33	-
Greenbone	50	25	-	-
Lamprey	75	12.5	12.5	-
Mutton birds	50	12.5	25	-
Pupu	60	20	-	-
Eel	70	20	-	-
Flounder	57	14	14	-
Paua	71.4	14.3	14.3	-
Mussels	50	25	12.5	12.5
Crayfish	66.7	16.7	16.7	-
Oysters	60	20	20	-
Seaweed	66.7	-	33	-
Koura	50	25	25	-
Watercress	37.5	25	25	-
Puha	45.5	18.2	27.3	-
Hapuka	50	25	-	-
Mullet	50	25	-	-
Kahawai	50	25	25	-
Kingfish	33	33	-	-
Gurnard	33	33	-	-
Snapper	33	33	-	-
Moki	50	25	-	-
Shark	50	25	25	-
Tarakihi	66.7	-	-	-
Trevally	66.7	-	-	-
Whitebait	70	10	10	-
Trout	14.3	42.9	28.6	-
Kina	75	25	-	-

As whanau explained:

Eels have diminished in number and they are probably the last species to be affected. You were once able to get crayfish you can't get crayfish in the local area. Paua again have diminished in number and size…..We now go to Moeraki to get them or elsewhere. Same thing for mussels they are virtually gone.

[7] Perceptions with respect to individual species are summarised in Table 8 with graphs included as **Appendix 1**

There are flounders we are finding now because of the quality of water in the lagoon and unless the mouth is open constantly then the patiki is muddy are horrible to taste. We don't even bother going out when the mouth is closed. It's tainted.

Our very best catchers can't get our customary take, as you can't get it. It's down to commercial eelers. Even 10 to 15 years ago if there was a tangi you could walk from the Temuka Bridge to the Manse Bridge which is about 800m and you would get at least a full bag of eel. Now you would be lucky to get two. You may get a dozen if three or four people were out with torches.

Watercress as well, there is a lot less around and the sprays they use these days and the run off from the farms in polluting the rivers.

Whitebait has dropped off in quantity with sometimes having a reasonable season but 99% of time it has diminished and more whitebaiters. Tuna is slowly disappearing.

5.2.8 Kai gathering behaviours

It cannot be assumed that all kai consumed is gathered by the respondents. Questions in the survey therefore asked about purchasing kai and sought to understand if it was shared within the whanau and wider community.

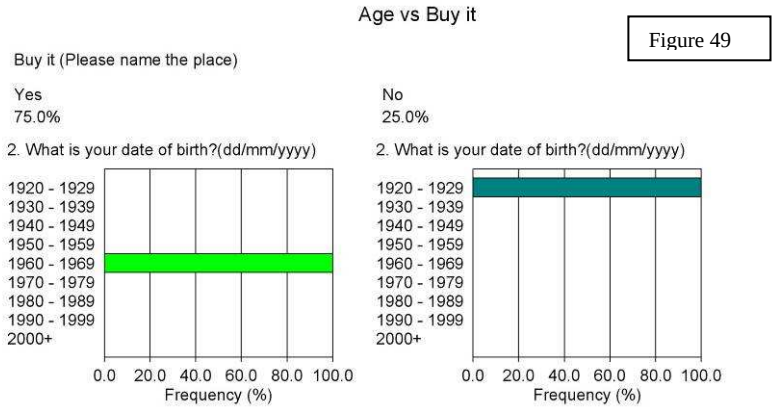


Figure 49

- 75% (all aged 40-49 years) buy some of their kai (Figure 49)
- The kaumatua did not purchase kai.

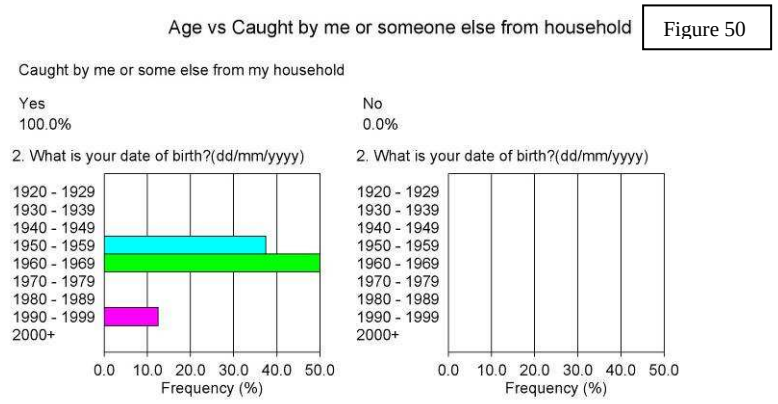


Figure 50

- Those aged 40-59 years and the tamariki confirmed that they caught their own kai (Figure 50).

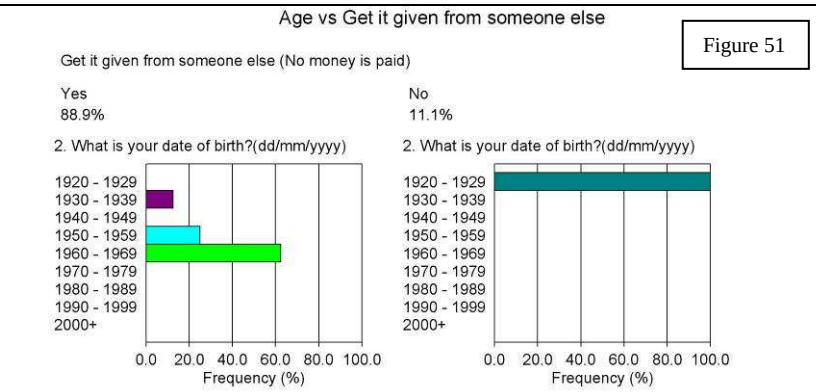


Figure 51

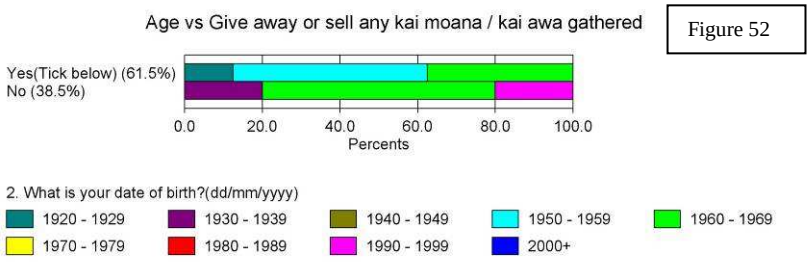


Figure 52

- 88.9% of participants said that they also were given kai (Figure 51).
- One kaumatua indicated that they were given kai from someone else as a koha while another kaumatua indicated that they were not given kai.

- 61% of participants gave away or sold some of the kai they gathered (Figure 52)

Aside from knowing how to gather kai, whanau need to know how to prepare the respective species.

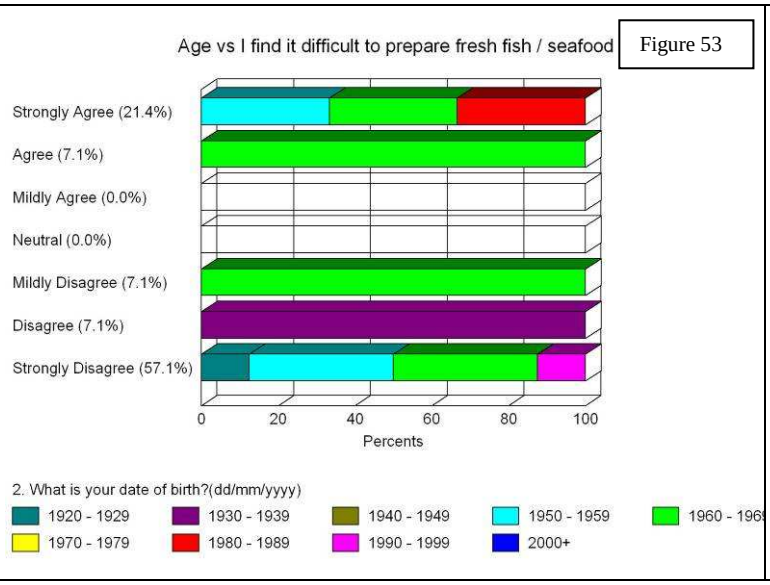


Figure 53

71% of respondents disagreed with the statement (57% strongly disagreeing) that it was difficult to prepare fresh fish and seafood. In other words 71% knew how to prepare their kai (Figure 53).

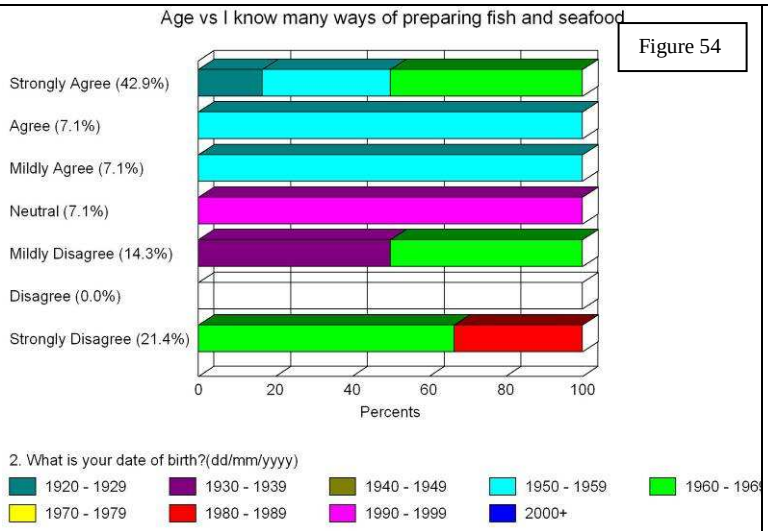


Figure 54

Of note however was the difference between generations.

Kaumatua disagreed with the statement. In contrast those: 57% of respondents (all aged 40 years and over) know many ways of preparing kai (Figure 54). In contrast and consistent with the earlier observation, those aged 20-29 years replied that they definitely did not know multiple ways of preparing kai.

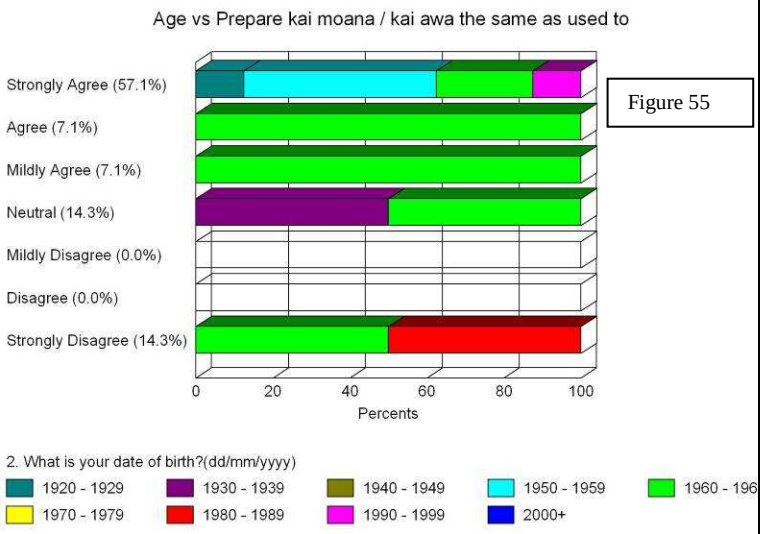


Figure 55

Interestingly Kaumatua (aged 70-79 years) also indicated they didn't really know many ways of preparing kai which could be interpreted as saying they prepare kai the same way that they have always done (Figure 55). In fact, 71% of respondents indicated they prepared their kai the same way as they have always done.

5.2.9 Perception of the environment

Maori experience environments and central to their continued interaction and utilisation of environments will be their perception of the good health of such areas. A number of questions in the survey asked for them to give an assessment of the condition of the sites from which they gather kai.

Figure 56

Responses were mixed when asked about the condition of sites (Figure 56), with:

- 35.7% believing sites to be in good condition while
- another 28.6% did not provide an assessment.
- only 28% appeared to believe that sites from which they gather are not in a good condition.

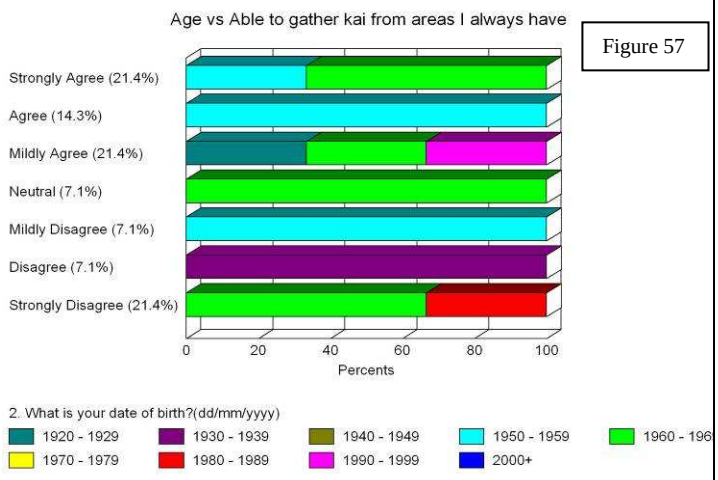


Figure 57

This is supported by the assessment of 57% of respondents (all aged 40 years and over) believing that kai could be gathered from the same sites that have always been accessed (Figure 57). An exception being a kaumatua (aged 70-79 years) who believed they could no longer gather from the sites they have previously been able to.

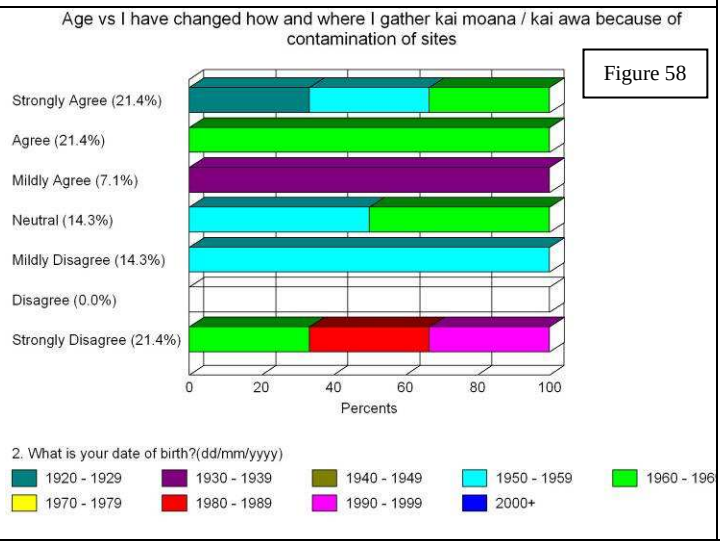


Figure 58

Responses were also mixed when asked about changing the sites they gather due to perceived contamination at the sites (Figure 58):

- Kaumatua agreed that they had changed gathering behaviours.
- 50% had changed their gathering behaviour (all of them aged 40 years or over).
- Those who strongly disagreed were all aged less than 40 years.

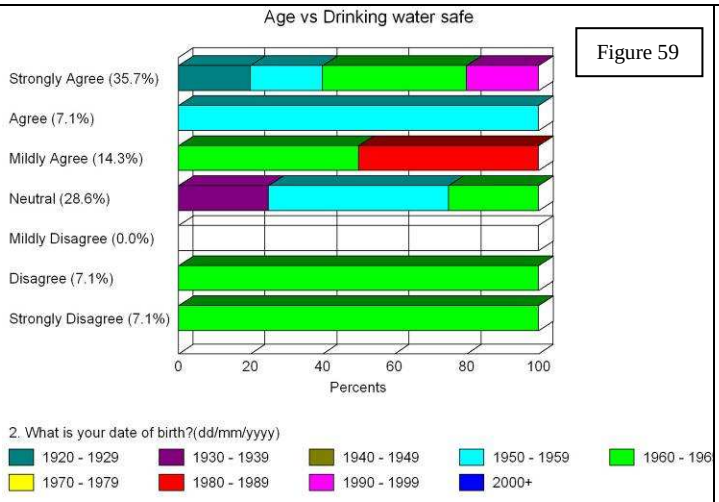


Figure 59

The majority of participants (56.8%) believed that their drinking water was safe (Figure 59). But 28.6% did not comment.

No clear trends emerged when asked if kai gathering was dangerous to the health of respondents because of pollutants or toxins.

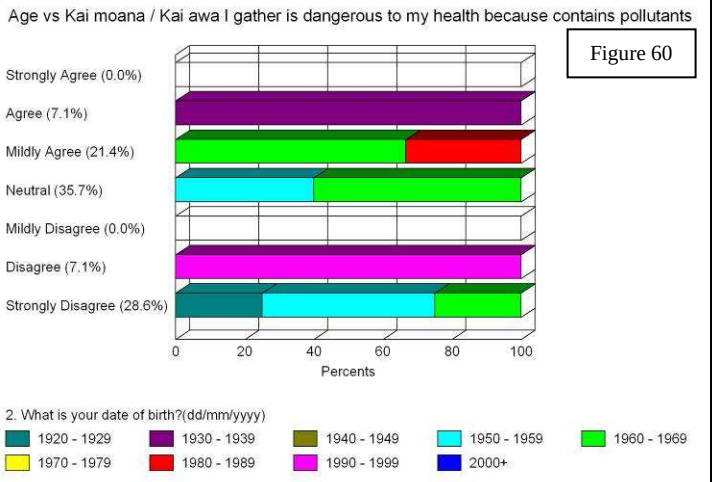


Figure 60

In relation to pollutants:

- 28.6% strongly disagreed with the statement that the kai gathered was dangerous to human health because of pollutants (Figure 60).
- However 35.7% did not provide an assessment.

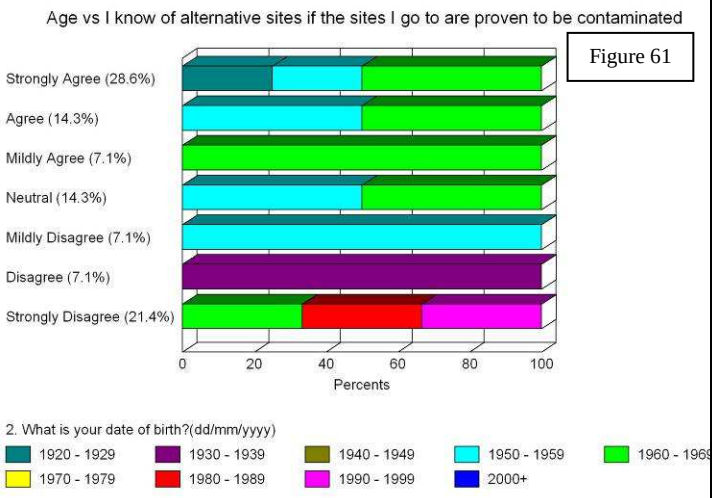


Figure 61

If a site is contaminated then the expectation would be that alternative sites would be used.

However only 50% knew of alterative sites that they could use (Figure 61). 28.6 strongly agreed.

Rangatahi and tamariki disagreed strongly indicating that they did not know how to change their behaviour and gather from alternative sites.

Whanau commented that:

The size of the lagoon has decreased because of drainage. At Temuka it used to be made up of 99% of swamplands and streams and places where eels used to be and watercress up the side but it's all drained and dry now. Creeks around the farms have been drag-lined and they

clean them out every two or three years so there is no place for the eels, no habitat and whitebait have no breeding ground. So that is why they are going down.

Washdyke we don't go there anymore because of industrial waste and if you go there it's for little as possible. You wouldn't go with all the pollution from the boats and things in harbour.

Tuna we are more worried about now because its the only thing left to us. The kanakana I go further afield because the habitat is not there anymore. The rivers are so low there is no soil banks they used to settle in to. Likewise with eel there is no real place for them anymore so their habitat has changed.

Because of low levels of river when gathering kai, like kanakana, you have to make sure the mouth is open and if its not to get same kai you have to go to Waihao.

The [taint] its worse with flounder and whitebait that's why I go to Orari now for whitebaiting. I would rather whitebait at Opihi but if water sits there for weeks and you catch it you can taste it and smell it when you eat it. Since the dams been up there the water quality down here has been bad.

5.2.10 Health of whanau members – Self Reported Rates of Diseases

Participants were asked to self report diseases prevalent in the family (Figures 62 and 63).

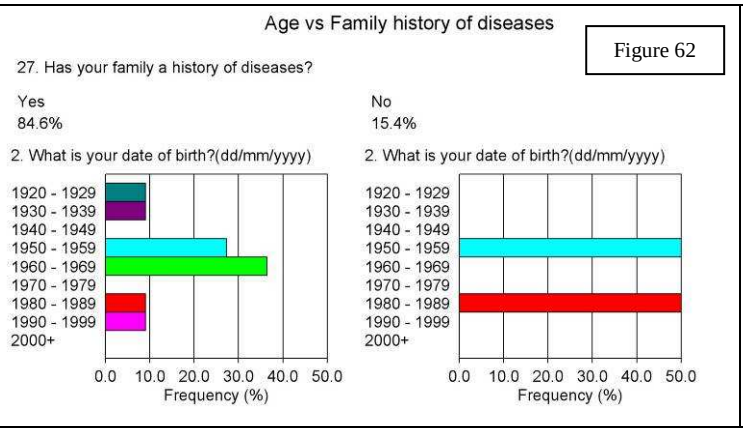
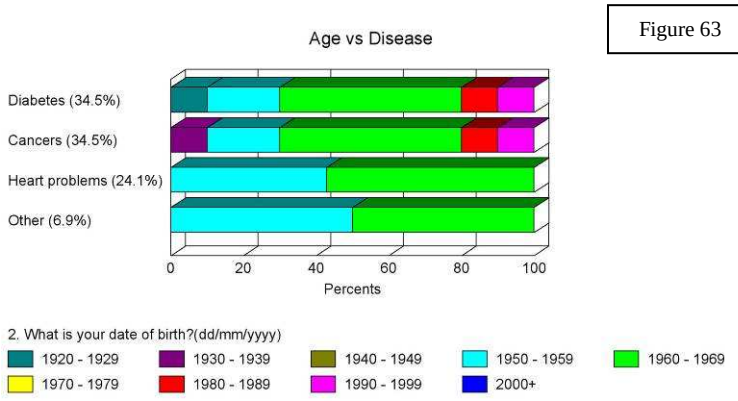


Figure 62

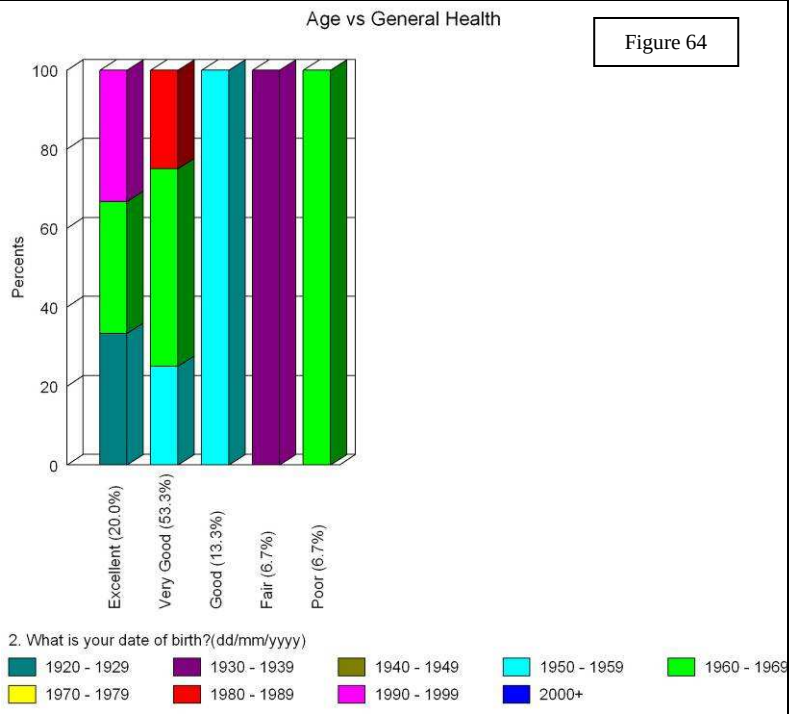
- 84.6% reported that there was a history of disease in their family.
- 34.5% of participants, across five age groups, reported a history of diabetes within their whanau.
- 34.5% of participants, across five age groups, reported a history of cancers within their family.

Figure 63



- 24.1% of respondents, all aged between 40-59 years, reported health problems.

Figure 64



Despite the prevalence of illness in their whanau (at above average rates) 87% of the individuals participating rated their health as good, very good or excellent (Figure 64). Only two of the respondents (one aged 70-79 years and the other 40-49 years) rated their health as fair or poor respectively.

Other age group observations:

- The eldest participant considered their health as excellent.
- All those aged 50-59 years rated their health as good or very good.
- The greatest variation was in the 40-49 years age group with participants rating their health poor, very good or excellent.
- As expected, the youngest participants (aged 10-29 years) considered their health very good or excellent.

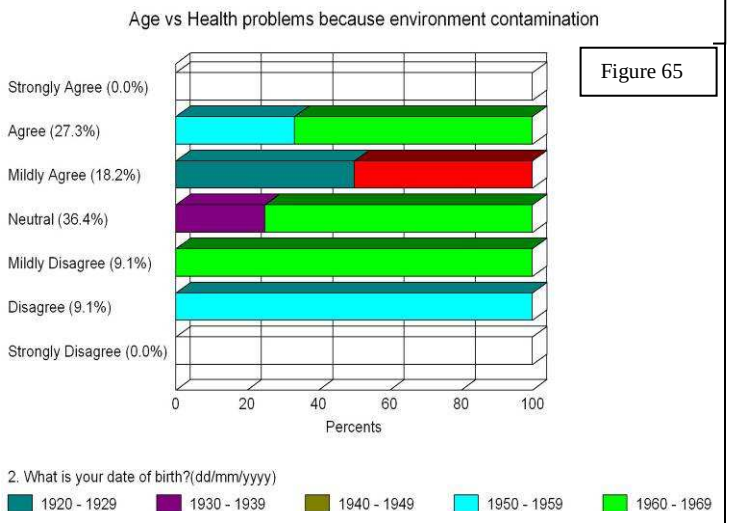
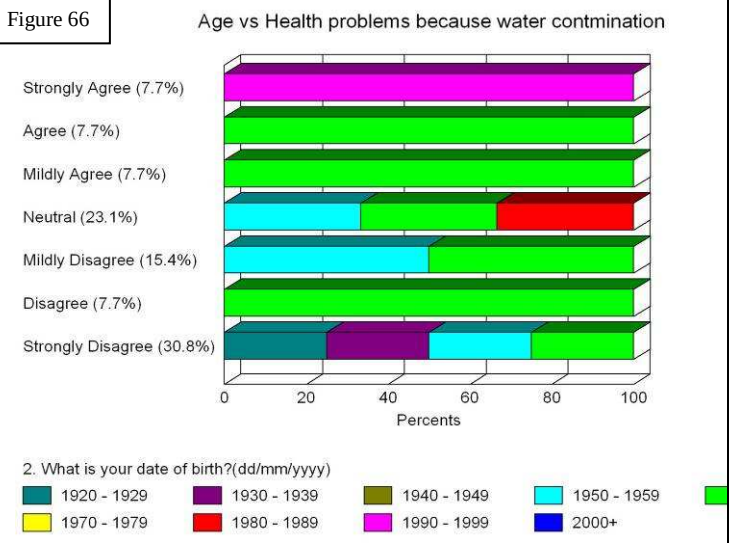


Figure 65

Two questions in the survey asked if respondents believed their health problems could be attributed to environmental contamination or more specifically water contamination (Figure 65).

With respect to environmental contamination, a third were neutral, while 45% of participants across most age groups agreed with the statement. Only those aged 40-59 years of age disagreed with the statement that their health problems were the result of environmental contamination.

Figure 66



Interestingly the majority of participants (53%) disagreed with contaminated water being the source of their health problems while another 23% provided no comment (Figure 66).

Kaumatua strongly disagreed.

5.2.11 Disseminating advice about contamination issues

One of the outputs of this research is to be a risk assessment framework. If it is to be implemented effectively it needs to reach grass roots Maori. A number of questions therefore sought data on how information should be communicated and who should be responsible for delivering the message.

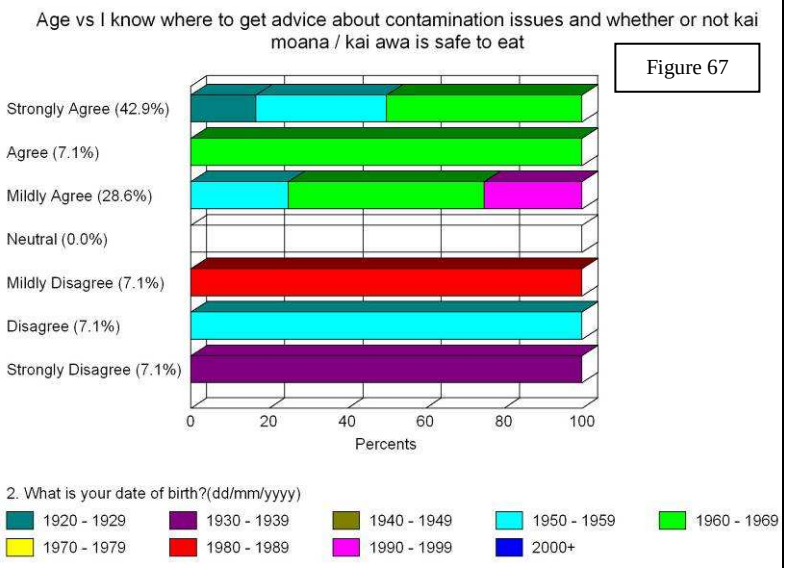


Figure 67

42.9% of respondents indicated they definitely knew where to get advice about contamination issues (Figure 67).

A further 35% responded less confidently but also said they knew where to get information from. Only 21% (and two specific age groups – rangatahi and Kaumatua) did not know where to go to obtain information.

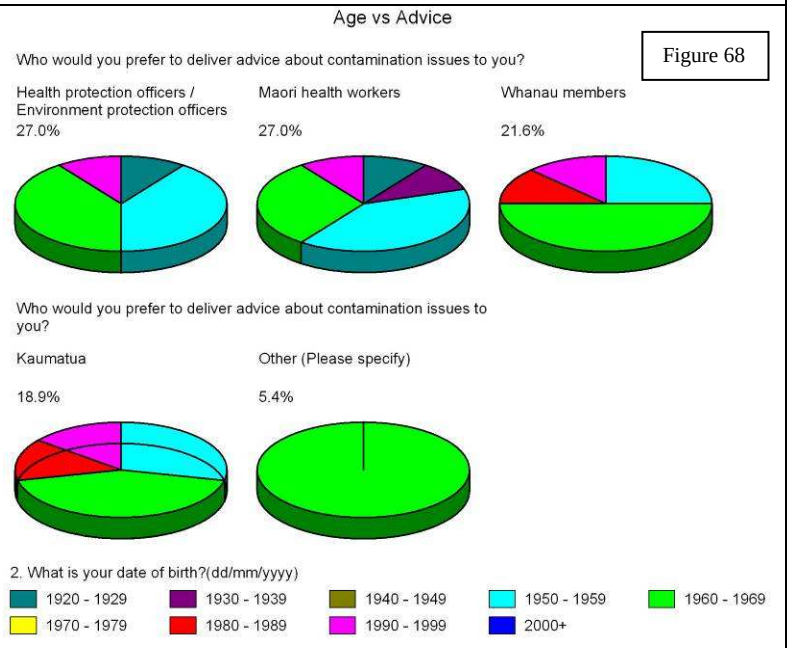


Figure 68

There is no clear preference for who should deliver the information, with similar preferences given to: HPOs/EPOS, Maori health workers and whanau members (Figure 68).

Similarly there was no clear preference with respect to the means of communicating which in fact suggests that a

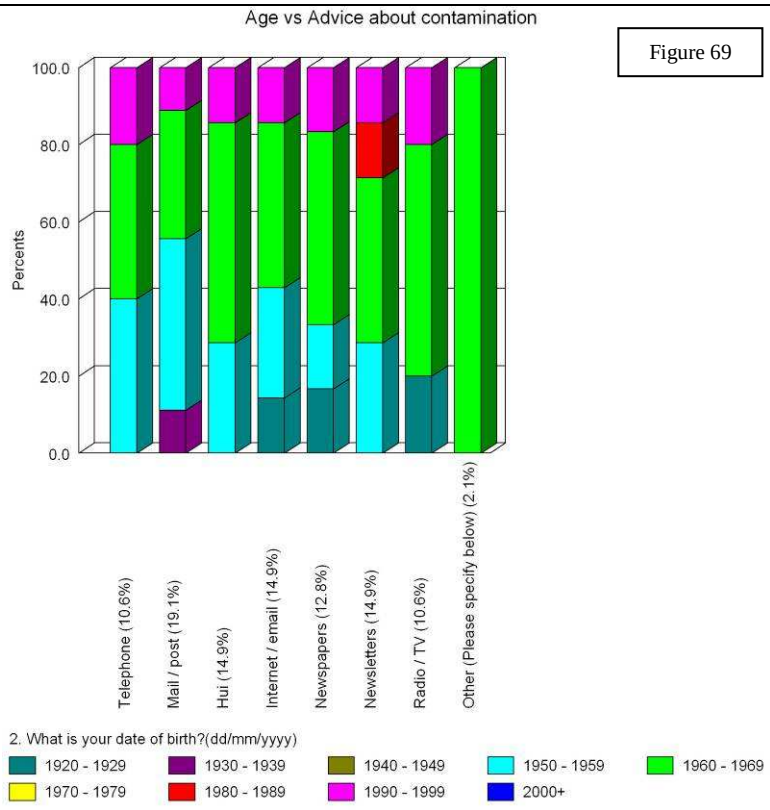


Figure 69

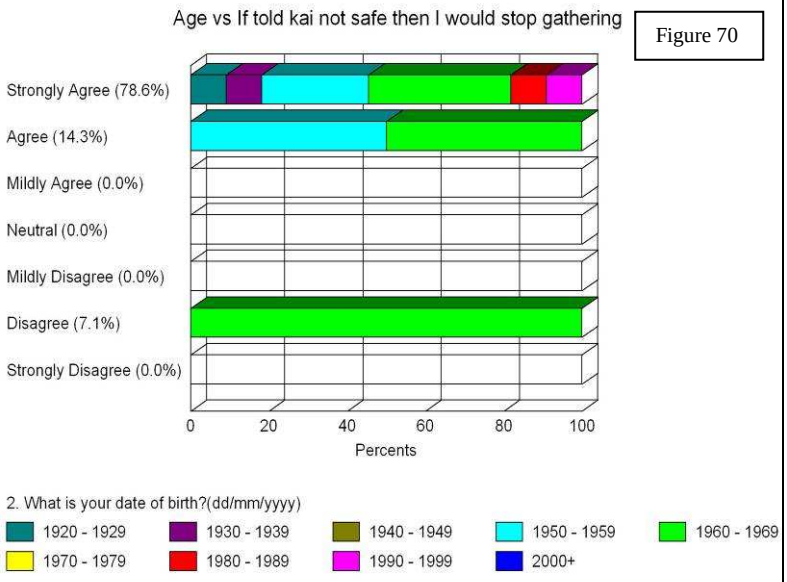


Figure 70

range of media should be used (Figure 69).

When reviewing the means of communicating we need to be cognisant of the equipment needed by whanau. Although not specific to South Canterbury, at the time of the 2006 Census:

- 66 percent of Ngai Tahu lived in a household with Internet access, an increase of 26 percent from 2001 (40 percent).
- 85 percent of Ngai Tahu lived in a household with access to a cell phone.
- 2 percent of Ngai Tahu lived in a household with no access to telecommunication devices (cell phone, telephone, and Internet or fax machine).

- The final result (Figure 70) concerns the long-term outcome of this result programme. Importantly, 93% of respondents (across all age groups) indicated they would stop gathering kai if advised that kai was not safe.

6. Discussion - understanding the socio-economic-cultural importance of kai to whanau and hapu

> *Indigenous relationships to the land are based in cultural practices. Harvesting of traditional foods is a central, material part of this relationship. A key problem for indigenous peoples occurs when, because of the practices of competing world views such as those often held by colonial states, practising these material connections becomes difficult. Problems ensue. These problems include issues related to health and well-being, and a disruption of well-established life-ways.* (Fediuk & Thom, 2003, p 1)

The discussion in this chapter re-examines traditional and contemporary consumption patterns of kai gathering, processing and consumption, the health of significant sites, and environmental change over the last 160 years to identify drivers of the transitions from a traditional kai based diet to a western diet. Insights, firstly, concerning the impact of dietary changes and secondly, the ongoing risk of exposure to contaminants and the impacts of this risk on the health and wellbeing of whanau are discussed. We have attempted to discuss these impacts in the wider political/social/cultural context in order to give a more complete reporting of cultural-environment relations.

6.1 Research results in the context of international literature

We have tried to convey the contradictions and challenges that surround the issue of contamination of kai:

1. Kai gathering contributes to the health and well bring of Maori by sustaining many cultural beliefs and values central to the identity of hapu. However the gathering of contaminated kai could be having a significant adverse impact.

2. Furgal (2003a) explains that the idea that potential health risks are associated with foods and a way of life previously regarded as “safe” has proved difficult to convey to Aboriginal peoples in North America. The individuals to whom risk information about the safety of their foods is to be conveyed have grown up living, hunting, and travelling over lands and rivers in a harsh and sometimes dangerous environment. Maori find themselves in the same situation of having to re-learn what is “safe” and what represents a health risk for them.

6.1.1 Structure of this chapter

Ngai Tahu have continually asserted their right to have their mahinga kai practices protected. However, many whanau in South Canterbury have witnessed the degradation of valued habitats and experienced significant barriers to gathering kai. They continue to express their concerns in a variety of fora. This chapter follows the format of Chapter 5 and discusses:

- patterns of kai consumption;
- estimates of the quantity of kai consumed;
- sites from which kai is gathered;
- preferred kai species;
- perceived changes in the abundance of species;
- kai gathering behaviours;
- perception of the environment;
- health and wellbeing of whanau members; and
- disseminating advice about contamination issues.

6.1.2 Patterns of kai consumption

Data from the 1879-1880 map prepared by Ngai Tahu Kaumatua was discussed in Chapter 5. This manuscript identified sites from which kai was gathered. This manuscript detailed of over 100 resources that were utilised. Analysis of the 1880 manuscript enables us to distinguish the following species sourced in South Canterbury. Of the 38 species identified there were:

- 3 species of shellfish
- 6 species of other freshwater fish
- 7 species of marine fish
- 3 species of birds

- 2 species of sea mammals
- 12 species of plants
- 5 ‘other’ species

Maori who relied directly on their knowledge of lands and rivers within their takiwa for food had access to aquatic species (eels, kanakana, waterfowl), terrestrial species (wild plants, berries, roots, and pollen), and the small game (e.g., rats) that were plentiful and sustained whanau and hapu. Figure 6 showing the location of reserves and easements depicts the scale of loss experienced by Maori following settlement. Historically a surplus of food was gathered as surpluses enabled whanau to access other resources through bartering, trading and gifting (and setting up reciprocal obligations). During the year whanau visited neighbouring hapu, taking surplus food to share. The practice of kai-hau-kai was a central feature of Ngai Tahu culture. Being able to gather abundant foods and thus able to engage in a range of economic practices ensured whanau had access to a variety of foods. Because of trade, however, people weren't restricted to kai immediately available to them from their local area but had access to a wide range of foods. When compared to the range of sites in Figures 4 and 5 it is apparent that Maori were denied access to a significant percentage of their traditional sites of kai gathering across South Canterbury and limited to a number of small reserves and easements located in the lower reaches of streams.

Indeed, many of the valued species gathered historically that were of high nutritional value are no longer available in quantities sufficient to enable them to be a primary food source. As Table 8 confirms most species are seen to be a “lot fewer” in abundance and many iconic species are now only consumed on special occasions. When the perception of species abundance is coupled with the species most commonly gathered in Table 3 and the preferences shown in Table 7, the decline of the eels resource is of particular concern. Sadly as one informant advised, kai is also often purchased for these special occasions – not gathered. Further, the condition of the kai may be compromised as well. Most distressing and representing a significant cultural loss, is the loss of entire species e.g., grayling, koura from some streams, weka.

While whanau made use of many species, the centrality of eels as a critical food source in South Canterbury is well known and reflected in the many initiatives across Te Wai Pounamu to restore populations. As Table 3 shows 72% of sites yielded eels. The current threatened populations of eels, especially longfin, contrasts with their abundance historically. Although some resources were gathered seasonally, historically whanau relied on eel year round.

Food security implies adequate access to affordable, high quality foods that are culturally acceptable. Although Table 3 showed that turnips and potatoes were grown by whanau once they were introduced to the south, this needs to be placed in context. Introduced crops could be grown in the south and a number of cultivations were established.

However, as explained in Chapter 5 introduced aquatic species were not seen as favourably and as the witnesses to the Waitangi Tribunal confirmed, introduced aquatic species were not seen by Ngai Tahu as substitutes of equivalent cultural, spiritual or nutritional value. It was therefore of interest that trout was noted as a preferred species by some respondents in the Kai Consumption Survey.

However if this is the abundant species and requires less catch effort than the declining indigenous species gathered historically, it is inevitable that some substitution occurs. It is clear from our research that whanau currently gather kai at quantities less than they did historically and at quantities less that they desire. This is discussed in the next section.

> *For eels. Full moon or any moon is out then you don't go out. If the moonlight touches the eel then it goes bad before you eat it so we don't go out during moon time.*
>
> *We restrict where we get kai like the wharf area or the outlet for sewage system or Temuka where the old wool scour was or where the settling ponds are because they sometimes overflow so we don't gather there. Or at the site where Temuka dump was we didn't gather.*
>
> *When at moana you don't eat the kai where you gather it and there are sites you avoid.*

6.1.3 Estimates of the quantity of kai consumed

There is little data available to enable calculation of pre-European contact per capita consumption of kai. Even if it was possible to determine harvesting levels for particular species, it is difficult to calculate how much food (and what species) on top of this would have been received as a gift or obtained through trade. For the calculation set out below in Table 10 we have assumed that historically fish would have been consumed on average once per day.

From interviews we know that wild source kai was consumed "at least 3 times" per week up until the 1970s and 1980s. Some whanau, however, eat kai daily. However a crucial time period – around the 1970s and 1980s – marks a significant change in the quantity of kai consumed as interviewees confirmed that more convenience foods

started to appear in whanau diets. Again to enable a calculation of kai consumption in the mid twentieth century we have assumed kai was consumed 3 times per week.

With respect to contemporary consumption, from the Kai Consumption Survey, 90% of respondents still consume kai awa, kai roto, or kai moana. For the comparative analysis in Table 10 we have extracted the quantities of fish consumed from the Kai Consumption Survey data as well as the frequency data (from Figure 25).

Table 10: Estimates of the quantity of kai consumed.

KAI CONSUMPTION HISTORICALLY	KAI CONSUMPTION UP IN TWENTIETH CENTURY 1970S, 1980S	CONTEMPORARY KAI CONSUMPTION
Assumptions • The data for estimating the quantity per sitting is that relating to "fish fillets[8]" • At least one meal of "wild kai" per day per person • Because of the abundance compared to the present, at least 10% more per setting would be compared to today's per sitting estimates 230.77 g per sitting per day Plus 10%	Assumptions • The data for estimating the quantity per sitting is that relating to "fish fillets" • At least 3 meals of "wild kai" per week per person • The quantity per sitting would be the same as today's per sitting estimates of 230.77 g	Assumptions • The data for estimating the quantity per sitting is that relating to "fish fillets" • The quantity per sitting would be the same as today's per sitting estimates of 230.77 g • Special occasions are estimated to be 6 per year. • 9% eat kai on special occasions • 9% eat kai average 2 times per month • 36.4% eat kai once per week • 27.4% eat kai twice per week.
Equals 253.85g per person per day	**Equals 98.90g per person per day**	**Equals 43.81g per person per day. This is higher than the average New Zealand consumption of 32.87g per person per day (Kim and Smith, 2006).**

The quantities for other species are considerably less.

- Contemporary consumption of whitebait — **Equals 7.48g per person per day**
- Contemporary consumption of mussels — **Equals 11.14g per person per day**

The Kai Consumption Survey asked respondents to identify quantities of various types of kai consumed. For the preferred species, as recorded in Table 6 the following observations can be made:

- The quantities available fall far short of levels desired by whanau who wish to engage in mahinga kai practices. The only two species that possibly approach

[8] It is assumed that the "fish fillets" estimate would apply for butterfish, greenbone, kanakana, eels, founder, hapuka, mullet, kahawai, kingfish, gurnard, snapper, moki, shark, trevally and trout.

adequate abundance are mussels and shark which respondents confirmed were available and often sourced from the supermarket or takeaway.

- It can be seen from Table 7 that for almost every species, the majority of respondents believed that populations were declining.

- The majority of kai is now only consumed on special occasions.

6.1.4 Sites at which kai gathering and other activities are undertaken

Major changes in mahinga kai behaviours began some 160 years ago with European settlement. Newly introduced foods replaced wild sourced kai principally because of the relocation of whanau and hapu to reserves, their assimilation in the mainstream New Zealand culture, and damage to the resource base resulting from use and development of resources by the newly arrived settlers. Interestingly many of the sites still utilised by whanau as shown in Figure 30 are found in close proximity to reserves and easements.

Although the initial loss of land occurred in the mid eighteenth century the interviews with whanau members (especially kaumatua) confirmed that they gathered many species until relatively recently and they believed that the most damaging changes occurred within the last generation. These observations confirm the period of 1970-1980 as a time of change.

The alienation of lands and resources has seen the mahinga kai practices of Ngai Tahu transformed. This transformation occurred at a time when resource degradation and environmental crises have precipitated the search for alternatives to dominant management systems (Berkes, 1991, 1994; Pinkerton, 1989; Stevens, 1998). Traditional knowledge, (or in the New Zealand context Matauranga Maori) is increasingly promoted as a valuable addition to scientific knowledge. However it must be recognised that the application of Matauranga has been disrupted and subject to interference. Nevertheless for some whanau, for some resources, in some areas, there has been regular, relatively uninhabited resource use through the generations. As the interviews and Kai Consumption Survey show many Ngai Tahu continue to gather and consume kai awa, kai roto and kai moana.

The fact that kaumatua contend that the most damaging changes have occurred in the current generation, when considered alongside the data showing that the 10% of respondents who don't eat kai are all rangatahi, suggests the assimilation of Maori into mainstream New Zealand lifestyles and diets is continuing. It also suggests that the loss of some mahinga kai practices may be quite marked in younger whanau members.

In South Canterbury, the declining abundance of aquatic species at many sites is attributed to water quantity issues arising because of excessive extractions, changes in flow patterns as a result of damming, and demands to divert or drain waterbodies. This clearly has the potential to place Ngai Tahu in confrontation with development interests as:

- the streams valued and utilised by Ngai Tahu are those most stressed;
- currently 88% of water allocated in Canterbury is used for irrigation; and
- Ngai Tahu believe some of the current land uses (that are totally dependent upon water supply) are unsustainable.

Two graphs from the Canterbury Strategic Water Study (Lincoln Environmental 2002) highlight the concerns of Ngai Tahu. Figure 71 shows that for irrigation, the Orari / Opihi catchment provides 5.7% of the total maximum allocated weekly rate of take. Yet as Figure 72 which follows shows, collectively the Orari and the Opihi represent only 1.3% of Canterbury's surface water resources under low flow conditions.

From Figures 35 to Figures 44 in Chapter 5 it is clear that many of the sites utilised by whanau are found in these catchments. Another more extreme example has the Ashburton providing 19.6% of the total maximum allocated weekly rate of take, while representing only 2.4% of Canterbury's surface water resources under low flow conditions.

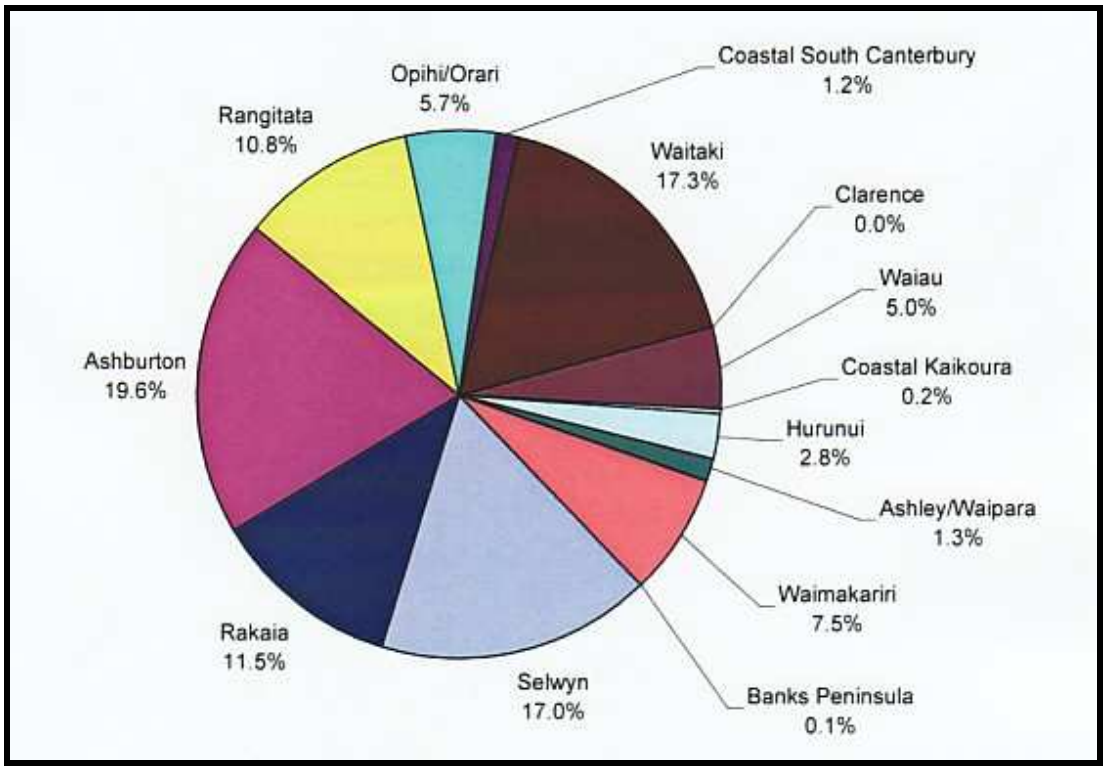


Figure 71: Proportion of total maximum allocated weekly rate of take that is supplied by each of Canterbury's water resource zones (Source: Lincoln Environmental 2002).

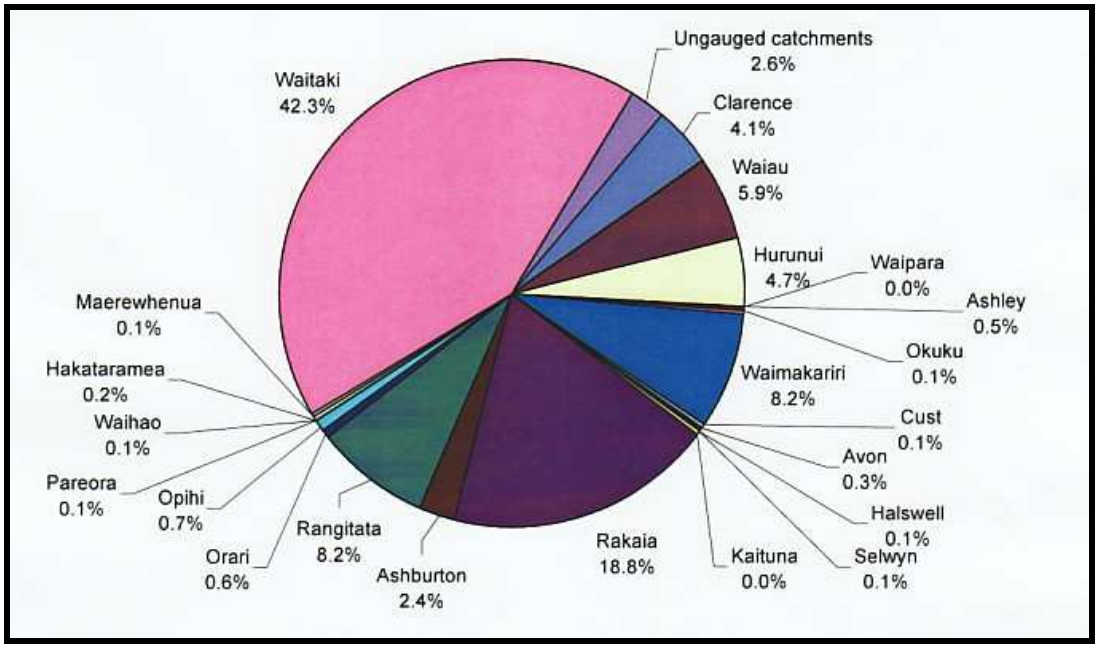


Figure 72: The relative size of Canterbury's surface water resources under low flow conditions (Source: Lincoln Environmental 2002).

While the previous two figures focused on surface water, Table 9 summarises the allocation of groundwater in the respective catchments and also confirms that the smaller catchments used and valued by Ngai Tahu are stressed.

Table 9: Revised Groundwater Allocation Summary[9]. **Issued** = granted consents outside any appeal or objection period. **Decided** = granted consents in the objection or appeal period, and consents that have been objected to or appealed. **In process** = applications for which no decision has yet been made. Total amount of groundwater currently allocated exceeds the allocation limit. Total amount of groundwater currently allocated is 80% of the allocation limit. Total amount of groundwater currently allocated is less than 80% of the allocation limit.

Zone	Allocation limit (million m^3/yr)	Effective allocation (million m^3/yr)				Zone status	
		Issue	Decided	In process	Total	Current & decided	In process
Ashburton River	69.5	69.41	0.00	10.17	79.58	100%	115%
Ashburton-Lyndhurst	126.6	128.79	0.00	8.25	137.03	102%	108%
Fairlie	37.0	4.58	0.00	0.00	4.58	12%	12%
Levels Plain	32.9	24.84	0.24	0.00	25.07	76%	76%
Makikihi	18.05	18.06	0.00	0.00	18.06	100%	100%
Mayfield-Hinds	148	125.68	0.00	5.09	130.77	85%	88%
Orari-Opihi	71.1	71.01	0.00	0.64	71.65	99%	101%
Otaio	4.93	4.76	0.00	0.00	4.76	97%	97%
Pareora	9.38	9.79	0.00	0.54	10.34	104%	110%
Parnassus	12.8	5.49	0.00	0.00	5.49	43%	43%
Rangitata-Orton	42.5	43.99	0.00	2.85	46.84	104%	110%
Valetta	96.6	106.10	0.84	29.41	136.34	110%	141%
Hook	2.49	2.87	0.00	0.80	3.67	115%	148%
Waimate	8.18	7.79	0.00	0.92	8.70	95%	106%

Interviewees believed that summer withdrawals leave some stretches of riverbed almost dry. The water is left dribbling in channels and gets lethally warm and polluted with agricultural runoff. Fish migration – upstream and downstream – is also severely compromised. In some catchments fish survival is dependent on access to isolated and disconnected large pools. Of particular relevance to consideration of contaminant levels, is the reduced assimilative capacity of waterways when only minimum flows are maintained – often for significant periods of time during summer.

[9] Sourced: Environment Canterbury http://ecan.govt.nz/services/online-services/monitoring/groundwater-allocation/Pages/groundwater-allocation-summary.aspx downloaded information was last updated 2 August 2010.

Interviewees expressed concern that both the regional council and Government seem to support and prioritise the beneficial use of water. Water has been allocated for agricultural purposes and these rights are defended vigorously. In contrast, non-agricultural purposes, such as leaving water instream to protect instream values, was and is still designated by some as "wasteful"[10]. From the perspective of Ngai Tahu the prejudice in favour of agricultural usage is still enforced. It is interesting to note that with respect to surface water flows, the following rivers are classified by Environment Canterbury as flow sensitive[11]:

- Opihi
    - Opuha (inflow to the lake).
    - Opihi.
    - Temuka River (Hae Hae Te Moana).
    - Kakahu River (upstream of Hall Road).
    - Tengawai River (whole catchment).
- Otaio – mainstem upstream of Otaio Gorge plus St Andrews Stream.
- Pareora River – catchment upstream of Pareora Huts and Taiko Stream.

Of concern when reviewing Figures 70 and 71, together with the summary of groundwater allocations in Table 9, and the list of flow sensitive surface waters are the catchments that are flow sensitive is hat many appear to be fully allocated or over allocated. To reiterate, all catchments that are valued and utilized as mahinga kai by Ngai Tahu are affected by low flows.

Other evidence to the Waitangi Tribunal by Ngai Tahu describes fish kills in rivers, while interviewees describe changes in the water quality and a deterioration of the condition of kai gathered. Decreased water quality is definitely a cause of denied or limited access to kai. Fertilisers and agricultural pesticides used in agriculture, especially the intensive agriculture of South Canterbury add to the deteriorating water quality. Table 10 summarises current water quality for some of the river used by whanau. Despite these assessments confirming water quality concerns, the waterways in Table 10 are still used by whanau (as shown in Figures 35-44).

[10] Sentiments expressed directly to whanau members – one by a Environment Canterbury staff member but more commonly by agricultural interests.
[11] Flow sensitive is defined in the Natural Resources Regional Plan as "a catchment that is vulnerable to reductions in summer low flows as a result of a change in the vegetation cover from short to tall vegetation.

Table 10: Environment Canterbury monitoring at swimming sites across Canterbury[12].

Catchment	Location	Result
Otaio River	Otaio Gorge	Fair
Opihi River	Saleyards Bridge	Fair
	Temuka River	Fair
	SH 1	Good
	Waipopo Huts	Fair
	Te Moana Gorge	Fair
	Waihi Gorge	Fair
	Lake Opuha – Dam boat ramp	Very good
	Lake Opuha – recreation reserve	Fair
	Lake Opuha – Ewarts Corner	Poor
Orari River	Gorge	Good

More recently Ngai Tahu have been denied access to kai due to increased gathering pressure by ethnic groups who either do not know or respect the tikanga and/or rules that regulate gathering.

In summary the sites still used by whanau are coming under increasing pressure - two types of pressure are being experienced:

- pressure on the use and development of aquatic waterbodies; and
- pressure on the aquatic species themselves.

In South Canterbury this pressure has led to conflict over the extent and impact of resource depletion and degradation.

As whanau explain:

> *Around the Waipopo area, from the Opihi River up, to Pleasant Point we would use the river for eeling, kanakana, floundering, yellow eyed mullet, herring. Around the mouth we would fish for kahawai.*
>
> *Around the Orari mouth we would use it for whitebaiting.*
>
> *Temuka, Opihi area is what we used for eeling. Right the way out to Winchester.*
>
> *Waitarakao was the name of Washdyke Lagoon…. My sister, me and her used to travel around there around gather flounders which used to be in the rocks. We used to gather karengo at certain times of the year on the rocks there. There were also eels taken there and whitebait … Kanakana was a favourite there and it's still there even though the*

[12] Environment Canterbury web page www.Environment Canterbury.govt.nz, downloaded 15 April 2008.

industrial area of Timaru has dumped a lot of its stuff into that area and it's considered polluted. So we don't go there as much now.

6.1.5 Preferred kai species

The principal foods from the Arowhenua archival data were from the main nutritional groups. As Williams (2004) explains:

- Kauru is a carbohydrate (and historically was gathered from 24% of sites).
- Eels are primarily a source of fats, but also sources of protein (gathered from 71% of sites).
- Mata/inaka, waterfowl and the Galaxiids are predominantly protein.
- Forest birds, kiore, kiwi and weka, combine protein and fat.
- Pora was a green vegetable.
- Aruhe was largely a "filler", eaten for bulk, and of low prestige; as was koareare.

Historically whanau and hapu consumed eels and titi as their main sources of fats. These were available in their greatest quantities in late autumn and early winter. Kanakana were a subsidiary source of fat. However South Canterbury was renowned for its kauru. As the main source of carbohydrate, great quantities of kauru were prepared. There is no record that kauru was preserved for consumption at a later date (Williams 2004), although McCallum (2007) describes how it was processed. Tikao describes the confectionaries made from kauru including fruit juices used as flavourings, and a type of jelly made with agar.

In contrast, the data from the Kai Consumption Questionnaire identified the contemporary preferences. Surprisingly, the top 6 according to the ratings (in order of preference) were:

1. snapper, koura.
2. kina.
3. trout.
4. pupu, pipi, cockles, herrings, oysters.

Eels which had been sourced from 71% of sites historically rated only 15th as the preferred food. However this is likely to be a reflection of how difficult they are catch because of their scarcity.

6.1.6 Seasonality of kai gathering

The following figures prepared by Anderson (1983) and Dacker (1990) illustrate the historical seasonal food gathering patterns for the southern region. Although some whanau adhere to these seasonal regimes, the technology (in particular the gear) available to fishers means that resources can be gathered all year round.

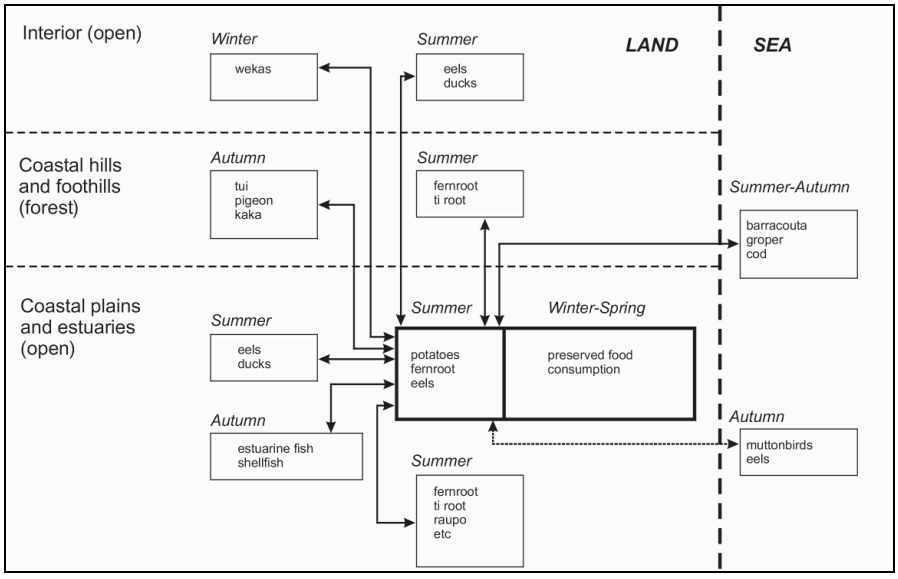


Figure 73: Seasonal Patterns of gathering (extracted from Anderson (1983:43, 1995:117)).

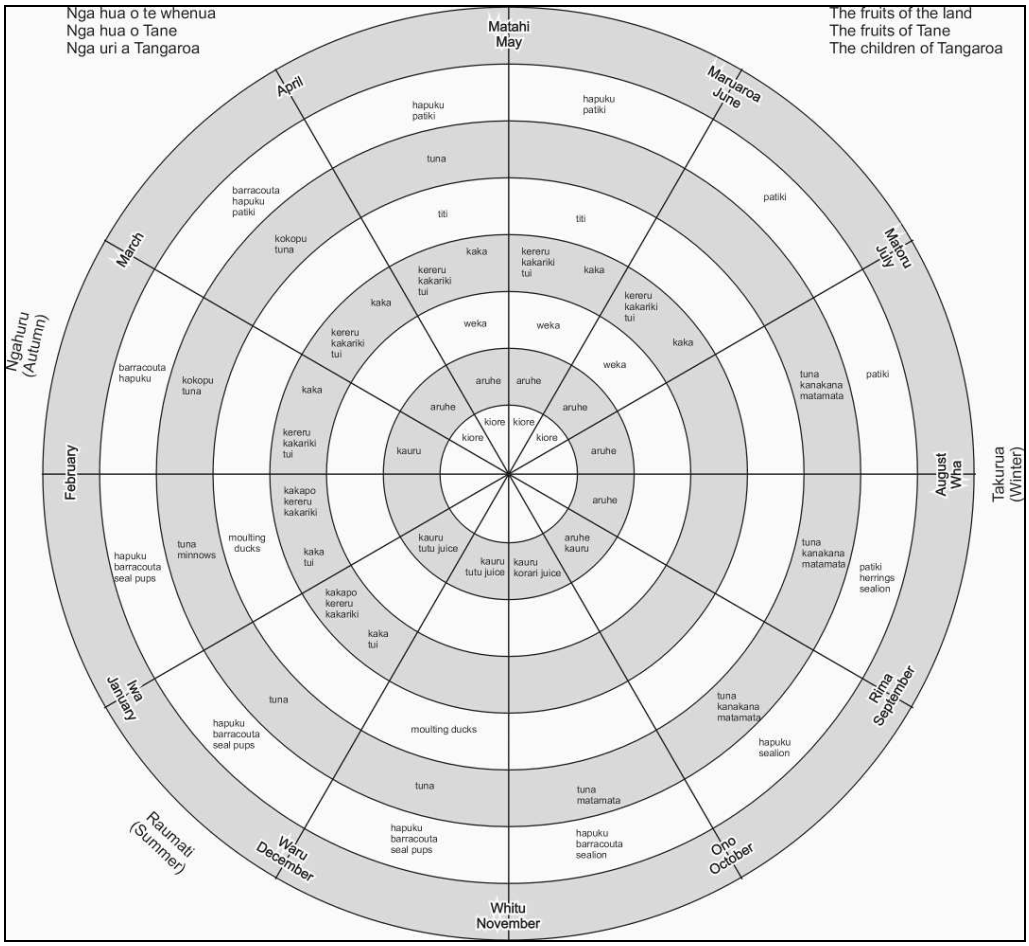


Figure 74: Seasonal Patterns of gathering (extracted from Dacker (1990:10-11).

The following Table has been compiled with the data from the Kai Consumption Survey identifies the seasons when species are gathered today.

Table 11: Seasonal kai gathering patterns today.

Species	Summer	Autumn	Winter	Spring
Herrings	■			■
Lamprey	■	■	■	■
Eel	■	■	■	■
Flounder	■	■	■	■
Paua	■	■	■	■
Mussels	■	■	■	■
Mullet	■			■
Kahawai	■	■		■
Moki	■			■
Shark	■			■
Whitebait				■
Trout	■	■		■
Kina	■	■		■

Key:

■ All the seasons when gathering occurs

■ When the most gathering occurs

Whanau commented -

> *It was all year round because the kai gathered from awa and moana were not supplementary but were essential.*
>
> *Eel have become lesser quantity and hard to get. We believe it's from commercial fisherman and they [eels] are smaller.*
>
> *About twice a year for eels and it really just to see what's there, its information gathering, because I just want to see if it's come back or if its better or if size of eels increased. I went out twice last year and you wouldn't spear as it wasn't big enough and it would be criminal to take. We just had a look around above lagoon to Railway Bridge in a night and it was a sad state of affairs. We hope things will get better.*
>
> *Kanakana is a little different as they are on a migratory thing as they in to breed in the mountains and they don't muck around. Between here and Railway Bridge (Opihi) it's a nights travel so if they come through early in night they will get to the Opihi Bridge and if they come in later then that's where I get them down here and stay in that ground so that why we go out at that time. Same thing at Washdyke they travel that quickly so anything in that line it only has come in that night so hopefully it's not polluted when we gather. Kanakana again it's sad it's hard to get and if you do get one it's a treasured source of food but more than that it good to see they are still there.*
>
> *Watercress is seasonal is usually goes with the frost but there are some spots under the willows.*

6.1.7 Processing of these preferred species

The processing of kai species also needs to be understood if all possible pathways of contaminants are to be identified. In this section only two species are discussed and the means of processing described.

1. Eels were often preserved as pawhera eels. The skin, backbones, heads and tails were removed and the eels hung out to dry. Curing them like this preserves them for months. For eating, they are softened by steaming. This process is called "pawhera". After this the eels are partly cooked and again dried. Flesh treated in this way could be stored for three years.

2. Titi (mutton birds) have long been an important food for Ngai Tahu, especially southern Maori who have control of the birding rights. Titi is a prized food. Once the chicks are collected, they are plucked and then the feet and wings are cut off. They are then dipped in wax to help remove the layer of down on the bird's body. Once hardened, the wax is cracked and removed, taking the down with it.

- "Poha titi" refers to the process of preserving the birds, whereby the hot fat retained from cooking the birds is poured into a kelp bag or kete and allowed to set, the flesh of the birds inside the pōhā is preserved for a very long time.
- Another method of processing is for the birds to be packed in salt and placed in buckets for shipping to whanau or to markets on the mainland.

Whanau also explained -

River and creeks used in that for rotten corn as well as fermenting spuds. We used to put them in there and brought them out and the smell was very strong.

They [tuna] were the main staple of our diet. Getting eel to supplement the table….. putting them in the deep freezer for the winter.

Anyway bring home tuna and clean it up myself.… I smoke some of mine and some I boil up in pot with watercress. The Maori boys showed me how to cook eels with watercress.

6.1.8 Perceived changes in the abundance of species that are gathered

A number of questions on the kai consumption survey sought to determine of the reasons for the dietary changes. The quantitative data summarised in Table 7 suggest the declining abundance of aquatic species in rivers is one of the main causes of diet change. However interviewees also reported degradation of aquatic environments, loss of access as a result of land tenure change, societal change (more specifically working longer hours) and government regulation as barriers to their engagement in mahinga kai activities.

Whanau were able to identify changes to different species -

A species that disappeared from when we were younger is koura. You would be lucky to see one. When we were young we would play in the creeks right down to the pa and we would take them home in jars. We can blame it on pollution in the Temuka River and they don't like that.

Amount of white baiters and the river systems have altered and the breeding ground along the side where they traditionally laid there eggs is just not there anymore and that's major reason.

Farming has changed this with drains being cleared out and the native grasses on edges are gone from banks and all you have now is a stream running through shingle.

For eel to gather half a dozen in half an hour and same with mussels back then. 10 mins on a reef there you would get enough.

When I went out early this year to get eel we went out at 8 pm to 2 in morning we only got 5 eels. Before you would have got that in 1 hour. Had to travel quite a bit to find them and the river has changed a lot since back then with a lot less water and there used to be a lot of holes where you could fish from but now you don't see that.

Loss of the numbers of eel and it's from commercial eeling because we used to find a lot of nets down river and we used to cut them up and let them go. And they got cunning and we can't find them now.

We don't seem to get the bigger eels. Four inches around anymore with them being a lot smaller now. Six of them used to be enough but with the size now you probably need 12 of them to get a decent feed.

6.1.9 Kai gathering – its contribution to wellbeing

The concept of mahinga kai extends beyond the nutritional value of species and its physical health benefits to encompass a range of cultural values. It describes species available locally and encompasses the cultural values attributed by whanau and hapu to these species as each is gathered, processed and distributed according to tikanga and kawa. Some of these values are discussed, albeit briefly, in the paragraphs below.

Whakapapa - Whakapapa is an important conceptualisation for Maori. Whakapapa is also central to kai gathering, which like many other cultural activities, is built around collective action (Ireson 1992, 1996). This is highlighted in South Canterbury where rights of manawhenua determine access to reserves and fishing easements.

Whanaungatanga - Kai gathering afforded opportunities for whanaungatanga bringing whanau together and enabling values and information to be transmitted from one generation to the next. A central tenet of whanaungatanga is to care for kaumatua and those unable to gather for themselves. After kai is gathered it is eaten together in groups of family and friends. It is therefore apparent that social capital built up through kai gathering could be more beneficial than those derived from more cotemporary individualistic activities, such as pataka. The development of these initiatives appears to draw upon these notions of social capital for cultural legitimacy.

Wairuatanga - Ngai Tahu and other Maori use different ways to feel spiritually connected with their takiwa. Gathering kai with whanau at a traditional fishing place, that they know was named by their tupuna and utilised by successive generations of their whanau, is one way. Being able to contribute the kai that their takiwa is renowned for, to ceremonies like kai-hau-kai[13] and to manaaki manuhiri can also bring that connection.

[13] Kaihaukai (Williams 2004) suggests breaking down the word kaihaukai into its component parts - *kai* (food); *hau* (obligation outstanding); kaihau ("Acquire property without payment or return made"

Manaakitanga - Although Durie (2004) contends that mauriora is dependent upon a secure cultural identity, diet changes can lead to loss of culture and identity. Having the ability to manaaki visitors by supplying kai sourced from one's takiwa means that the activities of fishing, eeling and gathering other foods creates and maintains community ties and reinforces identity. Conversely the inability to manaaki guests and sustain whanaungatanga can lead to cultural loss.

Matauranga Maori - As has been previously stated, the activities of gathering and preparing kai serves the functions of passing on traditional knowledge from one generation to the next. Matauranga Maori is developed and transmitted through practices of food management, harvesting and preparation. A great deal of knowledge is needed in order to obtain kai - knowledge of techniques and also knowledge of ecosystems. If populations of aquatic species do not return, knowledge of the techniques of gathering these foods along with the associated ecological and cultural knowledge and the process of gathering will likely also begin to disappear. Knowledge of preparation is also important. Yet as food species disappear from the dining table, the particular knowledge of how prepare foods is also lost.

Te Reo - That kai is instrumental to a culture is reflected in the stories and Te Reo that pertain to food. Te Reo contains knowledge and is an expression of culture and identity. Te Reo has been declining for many reasons, one of which may be attributed, in part, to changing lifestyles. When a valued species disappears from a local ecosystem, or the activities associated with a species decrease, the associated Te Reo drops out of usage. When 92% of the respondents confirmed that they would stop gathering if advised that species and sites were contaminated, the indirect cultural impacts that would ensue could represent a significant loss.

Cultural survival - This section has attempted to describe how kai gathering is the glue that binds whanau, hapu and community together, providing a sense of identity that also serves as the vehicle for the transmission of values and knowledge. Mahinga kai probably received more recent attention than any other tribal issue in the Ngai Tahu claim. Archived documents, including evidence previously cited in this report, provides in-depth testimony concerning the cultural and spiritual significance of aquatic kai species and of the water bodies across South Canterbury themselves. If contaminants lead to a further reduction in kai gathering, which is arguably at the heart of Ngai Tahu culture, at stake is nothing less than Ngai Tahu cultural survival.

Williams (1983:87)). Therefore kaihaukai, describes a feast which obligates those who received the feast to reciprocate. Williams (2004) explains that the kaihaukai was rather more complicated than as it was a form of trading, as there was a distribution of surplus food.

Hauora Maori - The presence of kaumatua represents "intellectual capital". They are holders of a wealth of critical information about the past and can draw on this knowledge to provide accurate assessments of environmental condition, including changes over time, at a localised level. The results from the Kai Consumption Survey confirm that differences in behaviours, perceptions and knowledge are found with the different generations. Loss of relationships with the natural world could lead to grief. Many feel whakama when unable to fulfil the social roles expected of their age groups. At stake with the loss of kai gathering is not only cultural survival, but potentially the physical and mental wellbeing of whanau members. The comments of whanau members support the statements above.

> *We learnt that from our mother and she learnt off her grandmother and we have passed it on.*
>
> *Anywhere we were taught to get kai was from mother and this became less and less as she had a great knowledge of what was safe in her head and what wasn't and we follow this.*
>
> *Kai is shared with whanau and extended whanau. If you have anymore than you need you would share. It's such a rarity to get kanakana that you first think of giving it to your elders. This has always been our way with giving away your first lot.*
>
> *Tuna was our staple. Temuka was renowned for tuna… Today there is nothing there in comparison. In those days the quantity there was more than enough and to share with visitors and today we have barely enough for ourselves let along share with our visitors which isn't good.*
>
> *…mainly taught by grandmother and grandfather they show you want to do.*
>
> *Always part of life we were brought up with it. I would love to give the same amount of attention to these areas and have them for my children when they grow up but with the lack of places to do what we want to do like eeling and catching kanakana the environment is not there. Then the whole process of teaching your children the same knowledge from parents and grandparents disappears as well. The whole community feeling of Maoridom goes as well.*
>
> *My children are in Christchurch and they would love to learn and I would love to teach them and they are getting less chance to learn. There is a lot of whanau around us and the younger generations are moving away from the marae and they are not coming back to the rivers and moana to get the food which we gathered with supermarkets being cheaper for them.*
>
> *It mainly for table.… I don't just go and get it for the sake of getting it. I would rather have it fresh.*

We always share what we get with family or with visitors from Christchurch and we would give them some to take away. Always been like that.

First to the kaumatua. That is a practice always it still down now. Even now with watercress and that's done regularly.

We had areas where we went to gather kai and you would see others (whanau). I am one of the only few kaumatua who gather kai. Though some kaumatua may get kai given to them from there whanau. Those practices still going on with some times I walk out and I see a bucket of cockles. This year alone I have had ducks, Canadian goose, cockles and paua.

The difference between now and then there was a need to put kai on the table because it was traditional it didn't matter how far you went. Sometimes it was on a horse and cart and it became a whole day thing. You all went out and gathered. … But that is all gone now. There is not a need now. But we need to exercise our customary rights. There is a perception out there that the river belongs to the trout. One of the main things when talking to Fish and Game. In the past there were eel drives where they would put them up on the banks and let them rot. This was to protect the trout.….

6.1.10 Perception of the environment

Questions sought information from interviewees about how they perceived:

- the abundance of kai species;
- the condition of sites from which kai is sourced;
- the changes to their gathering behaviours; and
- barriers to gathering.

The results in relation to the first three dot points have been discussed in the previous paragraphs. With respect to the perceived barriers, the results show that opinions varied. The results are collated and listed below, and complemented by the quotes of interviewees where appropriate.

Government and council actions acting as barriers

- Need for authorisation, permits and licenses before gathering – that restricts quantities to be gathered and the seasons of gathering.

- Introduction of the Quota Management System (QMS) for highly valued species (e.g., eels) and as a result commercial over-harvesting threatens populations.

- Mismanagement of waters, lands and resources by regional and district councils.

- Lack of any management input by Maori over lands, waters and resources.

- Lack of support to undertake stock assessments of valued species and if necessary implement restorative programmes.

- Redefinition of the customary right to a "non-commercial" right thus preventing restoration of bartering and trade.

Mahinga kai gathering is no longer able to be undertaken according to tikanga. Over time the cumulative effect of settlement and government regulation changed both the circumstances and practice of kai gathering, with both the river environments and the fisheries impacted. Many whanau no longer live in the catchment, kai is not their livelihood, and kai no longer their staple diet. Regulation tries to dictate what they gather, where they gather, and when they gather. But this knowledge – what, how and when - is the basis of matauranga – the knowledge that Ngai Tahu are supposed to possess. In other words the changing face of mahinga kai as a result of regulation also led to the practices, decision-making and knowledge generating processes associated with mahinga kai being changed or alienated from many Ngai Tahu resource users.

Environmental problems acting as barriers - South Canterbury has been heavily impacted by agricultural development and to a lesser extent urban and industrial development. Informants voiced their concerns at environmental conditions which they argued kept them from gathering kai:

- Sewage/contaminants from septic tanks, town sewerage schemes.

- Scarcity/limited availability of resources.

- Over-harvesting of resources.

- Intensification of agricultural land uses.

- Run off from farmland, especially from dairy farms.

- Discharges from industry e.g., scours mills, freezing works.

Land tenure change - Without doubt land loss alienated many whanau and hapu from mahinga kai gathering:

- Private land – many of the lands across South Canterbury were taken up by settlers by the late 1860s.
- Inability to gather on DOC lands.
- Recreational hunters/fishers gaining prominence.
- QMS instituting a property rights regime.
- Locked gates on private property limits access.

The most densely settled areas in South Canterbury are along the coastal margin while the river valleys that are ecologically productive and previously supported intensive mahinga kai usage, now sustain intensive agriculture.

Lack of Traditional Knowledge creating barriers - The practice of mahinga kai represents generations of learning and teachings about places, the resources they yield and the methods of gathering and processing resources. Internationally there are ongoing discussions about the loss or erosion of traditional knowledge as indigenous communities become more integrated into regional or national economies (Inglis 1993, Berkes 1994). It is recognized, however, that it is important to differentiate, between situations where matauranga held by hapu and whanau is adapting to new environments and economic conditions and where matauranga is being lost due to a disruption of its transmission.

But to understand ecological knowledge one must participate in the processes of hunting, fishing, gathering and processing of kai. In other words whanau with a history of use and those who continue to use waterways and resources are those that retain and continue to generate the matauranga. In this way, directly or indirectly, the whanau is the main perpetuator of the Ngai Tahu way of life and stories.

The data sourced from rangatahi suggest that they are experiencing the consequences of the loss of knowledge generation processes, while the comments of pakeke suggest they are losing the opportunities to teach. It is encouraging, however, that not all this knowledge is lost and given the opportunity, would be able to flourish in a re-invigorated cultural context.

As whanau explained –

Watercress you have to go upriver to get decent looking watercress because below the bridge you still got that backwater coming back it must build up and still come back and you can taste it. But up river the waters still flowing through and even the trout still taste better than below the bridge.

I go to the Orari if I want to catch some flounders as the river is free flowing.

Mouth open running straight should be….. It should be straight out so it can come in and then out to clean it out.

I have taken an eel from a good drain toward Clandeboye. It was a old haunt there. But I didn't eat it as it smelt of cow dung and I never went there again.

The things destroying the river are 4wd and motorbikes. They think it's a big deal to drive up the riverbed but they don't know what they are destroying.

They have put the price of rubbish dump up and what people are doing now are they are dumping along the riverbank now. It's a council issue.

I believe there are health risks because of practices over the years like the wool scour. We don't know what chemicals are going in and what that is doing to the watercress and the tuna. The other one that worried me were the timber mills around the area and I am always suspicious of the chemical they are using.

6.1.11 Health and wellbeing of whanau members – the mixed methods and contradictions

Toxic contamination and the resultant health impact on humans has received considerable research attention over the past three decades (Edelstein, 1988; Freudenberg, 1984; Perrow, 1984). This research seeks to explore the potential health consequences of the changing kai gathering behaviours sourced by whanau and hapu in order to determine the ongoing risk of exposure to contaminants.

Ngai Tahu continue to be dependent upon kai gathering both physically and culturally. Mahinga kai was the primary food source and the basis of an economy based on trade, barter and exchange. The transition from wild sourced kai which in the case of South Canterbury numbered more than 30 species to a western style of diet comprising commodity/convenience foods consequently impacted Ngai Tahu socially, culturally, economically and spiritually.

Physical health - Physical health is directly linked to the quantity and quality of food consumed, as well as the cultural, social and economic conditions within which individuals live. In the context of this research programme, physical health consequences arise from four factors:

1. changes in the nutritional value of foods consumed today compared to their traditional diet;
2. being denied access to gather also affects health by limiting the physical exercise associated with the act of gathering;
3. the risk of contamination of kai that is consumed;
4. the risk of contamination from the sites that kai is gathered from.

The loss of access and use of traditional resources is now recognised as being a contributor to a change to a western style of diet and the consequent rise in diet related illnesses which from an economic perspective could cost society. However the converse is also of concern as for those whanau who still gather kai there is a risk of exposure to contaminants from eating wild sourced kai.

An important health benefit of kai gathering results from the act of gathering itself – an activity that requires physical activity. The importance of exercise to general physical health is widely recognised. Traditionally Maori got a lot of exercise in the course of gathering kai. Although the amount of exercise that whanau get now as a result of gathering has declined, those surveyed reported engaging in some activity, although the frequency of such activity has declined as gathering behaviours have changed. However, it cannot be assumed that all gathering will be beneficial as the physical act of gathering resources could expose whanau to health risks as the sites where gathering occurs, specifically the waters and sediments, could be contaminated. The levels of contaminants in kai gathered and the environments in which they are found, will be reported separately. In addition, models describing possible risk to tangata whenua will be developed as part of the risk assessment and communication component of this project.

Wellbeing - The benefits derived from being in natural settings are also gaining increased recognition (Kaplan & Kaplan 1977, 1982). In addition to the data on diseases within the family (using data obtained from the Kai Consumption Survey), the interviewees described the broader social, economic and cultural impacts resulting from the changing patterns of kai gathering and consumption on their wellbeing – as individuals, as whanau and as a collective. The comments of informants describe the contribution of gathering and eating kai on wellbeing.

6.2 Implications for future management

The results of the Kai Consumption Survey show that the gathering and consumption of kai awa, kai roto and kai moana is highly complex. This is in terms of both the differences in availability of kai awa, kai roto and kai moana between hapu, the diversity of aquatic habitats, and the diversity within and between whanau. There is some indication that consumption levels are also related to the quality of kai awa, kai roto and kai moana that is available and the quality of aquatic ecosystems that they come into contact with when gathering. These results enable us to make a number of observations with respect to future management.

Sites from which kai is gathered - Where and when people gather kai is a function of the location of their work, the proximity of waterbodies, and other activities of a whanau. This is supported by Garaway (2005) who argues in relation to fishing that it is almost always combined with other activities. The Kai Consumption Survey confirmed that whanau are likely to go fishing in a nearby lake or stream thus reducing the time spent travelling between areas of work, home and collecting. For Ngai Tahu this means gathering from the lowland reaches of streams that are some of the most degraded in Canterbury. While many of the scenically attractive braided rivers of Canterbury attract attention from environmental organisations seeking their protection, it will be interesting to see who in the community, aside from Te Runanga o Arowhenua, will put their hand up to protect the many small waterbodies that support kai gathering.

Preferred kai species consumed - Knowing the preferences of whanau is essential if restoration initiatives are to target the priorities of whanau and hapu. If resources available for such initiatives continue to be limited, targeting funds to priorities is inevitable. A related concern that emerges when whanau do identify their preferences is that there are very few surveys undertaken to determine a "population baseline". Without this information it is difficult to determine what a sustainable level of customary harvest is.

Perceived changes in the abundance of species - If Maori are interacting with aquatic ecosystems on a regular basis they are ideally placed to observe changes – to sites and to species. Guidance is needed to ensure that their observations are part of a structured and robustly designed perception study so that they are not to have their observations dismissed as being "anecdotal". However, the challenge will be that few agencies support perception based assessments – let alone prove that a species is at risk and in need of management intervention.

Kai gathering behaviours - There is a complex mosaic of uses and users of aquatic resources within a takiwa that collectively shape the livelihoods of whanau and hapu. Kai gathering cannot be classified as one activity. Instead, they are part of a complex combination of activities for a range of members in a household. As the survey shows whanau hunt, and tend fruit and vegetable gardens. The effort afforded to gather kai is not a homogenous activity – it is a flexible activity that is undertaken by different people, at different times, targeting different species from different waterbodies using a range of equipment. Collectively this confirms a complex relationship between humans and their environment. It is important that information continues to be collected to increase our understanding of these range of behaviours, including their aspirations.

Disseminating advice about contamination issues - Furgal (1999) and Grondin and Carron (1999) argue that we need to consider both formal and informal networks when it comes to the circulation of information. Data from the Kai Consumption Survey confirms the need for formal and informal networks and suggests that advice could be provided by Health Protection Officers and Environmental Protection Officers, Maori Health Workers and whanau members.

While Maori have been active in developing relationships with resource management agencies, formalised relationships with the parties that can undertake the research necessary to understand contamination issues and deliver the messages, may need to be developed**.**

7. The next steps in the research process

Maori are faced with a "Catch-22" – whanau and hapu want to continue to undertake cultural activities, such as kai gathering, that they contend are central to "who they are". However because of the risk of exposure to contaminants, these same cultural activities could be the cause (and not the cure) of some of the ills being experienced by whanau and hapu.

This report has shown how looking beyond simple representations, such as consumption, reveals the complex and diverse role of both kai awa, kai roto and kai moana in the behaviours of whanau and hapu. Further, kai awa, kai roto and kai moana are accessed in diverse and complex ways.

The results from the Kaimoana Consumption Survey clearly support the statements found in archival records, and as articulated to the Waitangi Tribunal in 1989-1990 that kai awa, kai roto and kai moana are vitally important to whanau and hapu in South Canterbury. It appears that, consistent with the cultural values of whanaungatanga and manaakitanga, there is significant distribution of kai outside of whanau. For hapu, kai awa, kai roto and kai moana continues to represent a food source upon which all members of a hapu can subsist if the health and abundance of species and the condition of valued sites are assured.

Kai awa, kai roto and kai moana are also represented in terms of their wider social and cultural importance. Being able to maanaki visitors and provide kai sourced from your takiwa remains of fundamental importance. Other forms of provision, such as purchasing kai and / or having it supplied through systems such as pataka, have drawn on the social and cultural values associated with gathering kai awa, kai roto and kai moana to be legitimised within both Maori and government institutional planning. Arguably the outcome is that kai awa, kai roto and kai moana threatens to be reduced to 'availability' and species is increasingly becoming synonymous with supply from commercial fishers rather than customary gathering.

7.1 Next steps

Using the site specific data and the species data that resulted from the Kai Consumption Survey, the next stage of the research will identify the types and levels of contaminants present in the "wild kai" and associated habitats identified by Maori.

The analyses that are proposed at the next stage will then enable the researchers to establish potential pathways of contaminant bioaccumulation via the food web. This information will then be available to whanau from Te Runanga o Arowhenua.

7.2 Disseminating advice about contamination issues

> *Communicating the risks of environmental contaminants in the food chain to northern Aboriginal peoples poses significant challenges for communities at risk and environment and health professionals alike..… communication practice on this issue include increased fear and confusion in northern communities, changes in the dietary behaviour and traditional lifestyles of their residents, and associated impacts on their society, economy, and health. … The importance of this information is increasing as research begins to detect subtle health effects from exposure to these substances among newborns in some northern regions. Thus planning and evaluation are needed for risk communication, and possibly changes to the scale at which communication work is done in northern communities.* Furgal et al., (2004).

Frugal (2003a) contends that some of the challenges associated with communicating contamination risks are unique to the specific issue and the context of communities. This chapter has repeatedly stressed the contradictions or the Catch 22 that Ngai Tahu find themselves as a result of trying to balance two potentially conflicting perspectives:

1. the health and wellbeing benefits that results from the continuing practice of gathering kai or conversely the impacts that arise when changing from a traditional lifestyle and diet; and
2. the adverse impacts on health and wellbeing arising from contamination of aquatic ecosystems and the potentially the kai species themselves.

The cultural comprehension of what is “risky” behaviour is complex. Maori, like those in other indigenous communities, have limited experience with food safety issues similar to that of contaminants in foods they gather.

Understanding how indigenous communities perceive contaminants, has significant impacts on the reception and effect of messages delivered. Usher et al., (1995) contend that communities may distrust the information they receive about contaminants in foods and their distrust could affect their reception of further explanations or clarifications. Furgal et al., (2003a) found that concerns over contaminants was not a determinant of food choice in one Labrador community, yet Kuhnlein et al., (2003) reported that 42% of women interviewed in five western Arctic communities indicated “concern over contaminants” as a reason why they did not serve more foods to their families. The objective of this research is to effectively

convey to Maori the risk of gathering kai. Overseas research indicates a number of aspects need to be addressed.

The advice to be delivered - A minimal amount of work has been undertaken to identify the types of messages that elicit certain or desired responses. Usher et al., (1995) indicates that good messages are direct, simple, not condescending, put in a personal context, accurate, translated into local languages, delivered early and often, and build upon local understandings and knowledge of the issue.

Materials to be presented - Numerous forms of materials have been used to communicate messages on contaminants and country food in North America including posters, fact sheets, reports, pamphlets, personal letters, radio public service announcements, radio call-in shows, regional video programs, door-to-door or face-to face communication, community meetings, school curriculum materials, and national live television broadcasts (Furgal et al., 2003b). From the Kai Consumption Survey we know that a range of media are likely to be needed.

Delivering the advice - To be effective a message has to be distributed through pathways that ensure it will reach and engage the target audience - in this instance, hapu members who gather kai. Furgal (1999) and Grondin and Carron (1999), in their work with northern hemisphere communities, identified the need to consider both formal and informal pathways of delivery and information circulation. Data from the Kai Consumption Survey confirms the need for formal and informal networks and suggests that advice could be provided by:

Formal networks:	Health Protection Officers and Environmental Protection Officers
	Maori Health Workers.
Informal networks	Whanau members

Specificity - Vaughan (1995) and Slovic (2000) contend that personal experience, gender, age, socioeconomic status, and profession influence perceptions of risk. Understanding how Ngai Tahu see the issue is critical to ensure that the communication is best oriented towards their understandings and perspectives.

McGrath (2003) argues for a relationship based approach to exchanging knowledge on issues such as contaminants within and between communities. This will require scientists and communicators to understand the informal paths of information flow in communities so they can develop mechanisms that support and utilise these pathways to communicate information about contaminants.

> *One might argue that little true "communication" on the issues of contaminants, food, and health has taken place between scientists, health professionals, and Aboriginal residents in many northern communities; rather, a great deal of scientific information has simply been disseminated* Leiss (1997:29).

Understanding and developing ways to better communicate information on contaminants and their impacts on health is critical. Reports of contamination can undermine confidence of whanau in their environment and gathering of resources as a source of individual and collective well-being.

As whanau explain -

> *All we have is speculative information about kai. If we had scientific information about what's in our kai and the area of where we are gathering kai if it could dangerous then we would make decisions about that.*
>
> *As long as area is clean then it's no problem. Going back to the lagoon it's a big risk to eat from there. I don't know anyone being sick from it. But it would be silly to eat anything from there because you can see the water before you get there.*
>
> *I wish they would do something about the river here. It's getting worse every year. Since the dam has been up we have never had a real flood to clean out river. We have just had a lot of rain and you should smell the lagoon now it smells nice and fresh. It washed the river through. You need that fresh water to clean the river. I may go down to the Opihi this year since there has been a fresh going through it.*

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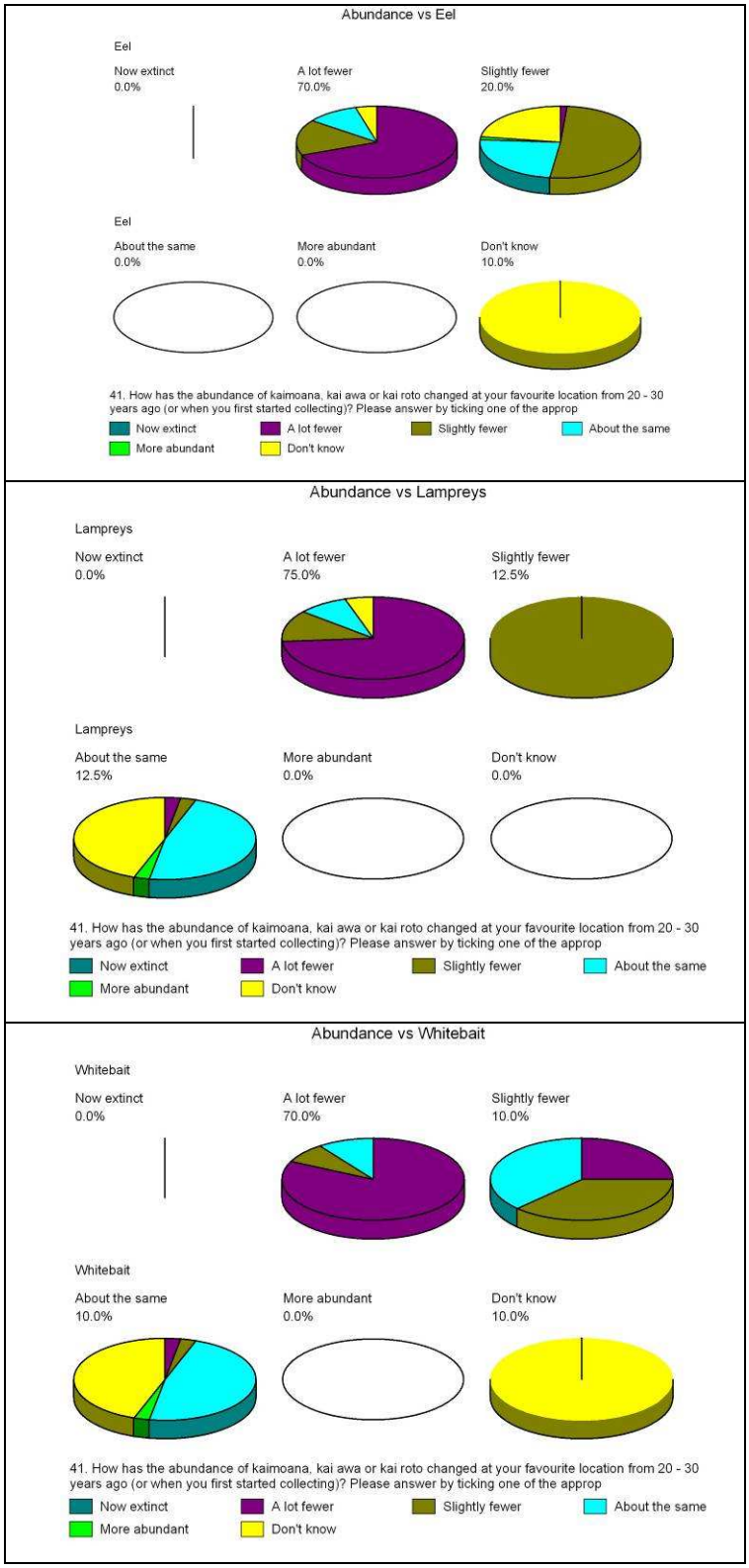
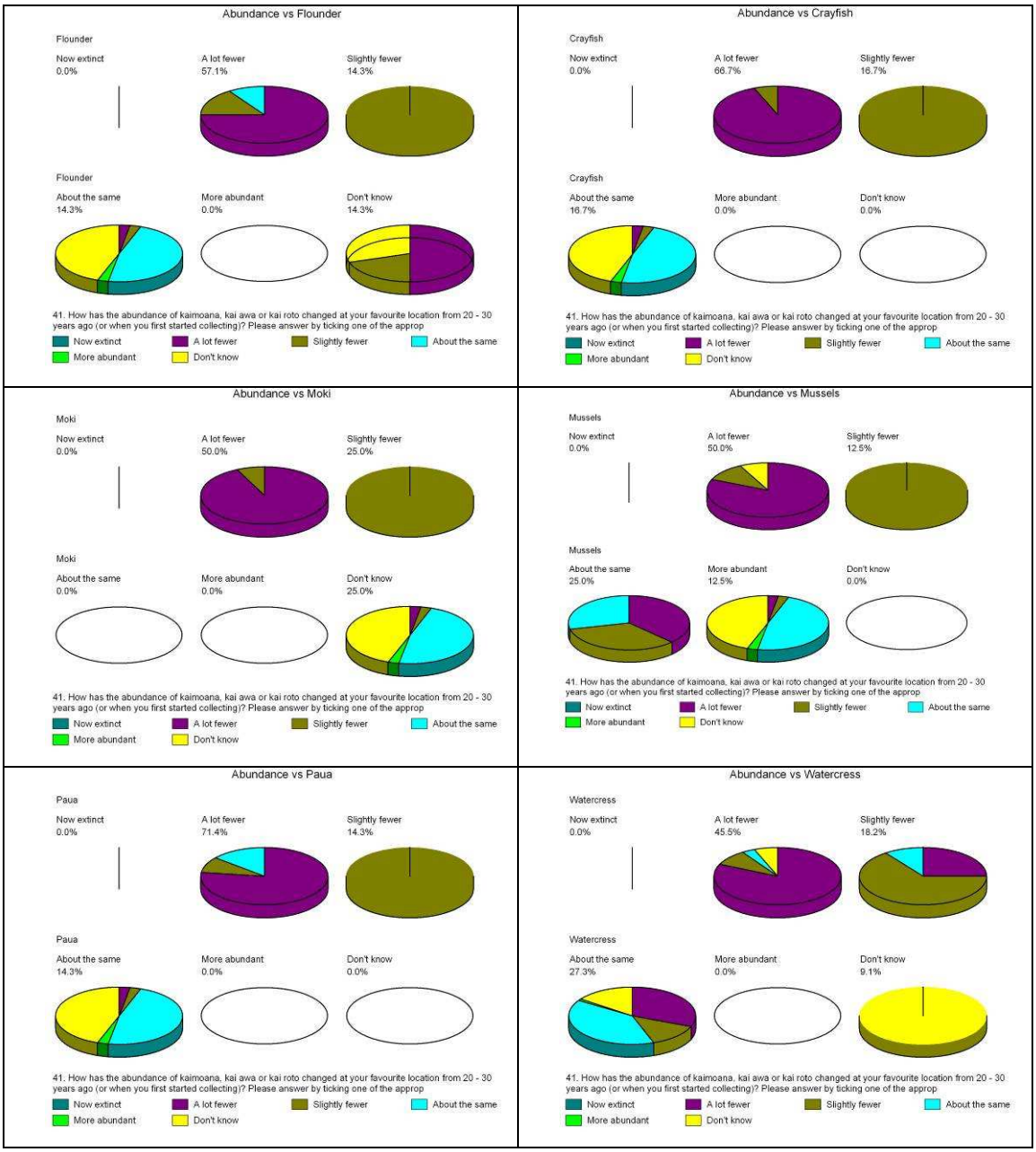
J:10, H:1, H:10, H:47, H:49, F:11, P:15(a).

9. Acknowledgements

We wish to thank the tangata whenua of Te Runanga o Arowhenua for the opportunity to undertake this mahi with them. We also acknowledge the financial support on the New Zealand Health Research Council (HRC Ref: 07/240).

10. Appendix 1: Perceived changes in abundance of species




Abundance vs Flounder
Flounder
Now extinct 0.0%
A lot fewer 57.1%
Slightly fewer 14.3%
Flounder
About the same 14.3%
More abundant 0.0%
Don't know 14.3%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know
Abundance vs Crayfish
Crayfish
Now extinct 0.0%
A lot fewer 66.7%
Slightly fewer 16.7%
Crayfish
About the same 16.7%
More abundant 0.0%
Don't know 0.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know
Abundance vs Moki
Moki
Now extinct 0.0%
A lot fewer 50.0%
Slightly fewer 25.0%
Moki
About the same 0.0%
More abundant 0.0%
Don't know 25.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know
Abundance vs Mussels
Mussels
Now extinct 0.0%
A lot fewer 50.0%
Slightly fewer 12.5%
Mussels
About the same 25.0%
More abundant 12.5%
Don't know 0.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know
Abundance vs Paua
Paua
Now extinct 0.0%
A lot fewer 71.4%
Slightly fewer 14.3%
Paua
About the same 14.3%
More abundant 0.0%
Don't know 0.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know
Abundance vs Watercress
Watercress
Now extinct 0.0%
A lot fewer 45.5%
Slightly fewer 18.2%
Watercress
About the same 27.3%
More abundant 0.0%
Don't know 9.1%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

11. Appendix 2: Sites and species identified by iwi participants (number of respondents)

Kai	Opihi River upstream of SH bridge	Opihi River below SH bridge	Opihi River Mouth	Orari River Upstream of SH bridge	Orari River Mouth	Ohapi Creek	Temuka River	Waihi River	Te Hae Hae Te Moana	Jacks Point	Washdyke	Otaio River	TOTAL	Other
Watercress	6	7	3	3	4	2	5	3	2				**35**	Awarua (x3), Temuka, Te Umukaha
Eel	7	4	3	2	2	2	5	3	3	1	1	1	**34**	Te Umukaha
Trout	5	3	2	1	2	1	5	2	1	1	1	1	**25**	Te Umukaha
Whitebait	1	4	6		3		3				2		**19**	
Flounder	1	2	5	1	2		2			1	3		**17**	
Herrings		2	3	1	1					1	1		**9**	
Lampreys	1	1	1		1		2	1			1		**8**	Waihao
Mussels										5	1		**6**	Timaru (x2), Teaitaraki, Jacks Point, Moeraki
Kahawai			2		1					1			**4**	Teaitaraki
Mullet		1	1							1	1		**4**	Teaitaraki
Oysters										1	2	1	**4**	Patiti Point, Bluff
Shark			2							1			**3**	Moana
Puha							3						**3**	Temuka, Te Umukaha, Awarua (x2), all over
Paua										3			**3**	Teaitaraki, Jacks Point, Moeraki
Seaweed										1	1		**2**	Wales
Crayfish										1			**1**	Kaikoura, Teaitaraki (x2), Moeraki
Kina										1			**1**	Teaitaraki
Muttonbirds													**0**	Titi Island (x3), Papatea
Cockles													**0**	Warrington, Karetane
Freshwater mussels													**0**	Pareora (x2)
Tuatua													**0**	Teaitaraki
Freshwater crays													**0**	Pareora (x2)
Greenbone													**0**	Papatea, Bluff
Toheroa													**0**	Oreti
Pupu													**0**	Moeraki
Hapuka													**0**	Moana
Kingfish													**0**	Nelson
Snapper													**0**	North Island
Moki													**0**	Timaru
Tarakihi													**0**	Timaru
Trevally													**0**	Timaru

A survey of wild kai consumption in the Arowhenua rohe

NIWA Client Report: HAM2010-098
August 2010

NIWA Project: HRC08201

A survey of wild kai consumption in the Arowhenua rohe

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Contents

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Formatting checked

Executive Summary

Waterbodies impacted by pollution and suffering environmental degradation represent a risk to the health of both aquatic organisms and humans. Even at low concentrations contaminants, particularly organic compounds, can cause long-term impacts and pose significant risks to the health of biota and humans. Human health may be threatened either by the consumption of food (especially fish and shellfish) contaminated with pollutants, or by direct exposure (via water and atmosphere during collection) to them (Boesch and Paul 2001). This research, funded by the New Zealand Health Research Council over a three year period, ultimately aims to improve Maori health by identifying, quantifying, and effectively communicating the risks associated with the collection and consumption of wild kai.

Wild kai, gathered from the sea, rivers, and lakes, has always been an integral component of Maori lifestyles, but today is increasingly susceptible to contamination. The impacts of environmental contamination in wild kai on Maori have not been investigated to date. The present research sought to address this shortcoming. As part of the first phase of the research, Maori from three communities were asked to identify species, locations and quantities of kai moana, kai roto and kai awa consumed. This was to enable the levels and types of contaminants in the kai to which Maori are exposed to be determined, and pathways of potential contaminant uptake by tangata whenua investigated by analyzing relevant food-chain components.

Three Maori communities were involved in this research: Te Arawa: centred around the Te Arawa / Rotorua Lakes and Maketu coastal area; Ngāti Hokopu ki Hokowhitu: centred around Whakatane; and Te Runanga o Arowhenua: centred on South Canterbury. The three communities differ in their access to and use of aquatic resources. Each community is characterised by different physical, natural, social and political capital which directly impacts on the level of kai awa, kai roto and kai moana gathered and consumed. In each region the diversity of aquatic ecosystems utilised, with spatial and temporal patterns of gathering unique to the each place and community, reflect a history of complex, locally specific tikanga and kawa driven behaviours. Exploring the complexity of this inter-community variation was beyond the scope of this research.

This report documents the results of the first phase of the above research programme, specifically investigating the level of kai consumed by members of Te Runanga o Arowhenua, whose whanau have resided in South Canterbury for centuries. For centuries the rivers, streams, wetlands, lakes and hapua have also been the mainstay of their economy providing freshwater fish, shellfish, waterfowl, and plants.

With respect to the research design drawing on the earlier work of Bebbington (1999), importance of kai to whanau was examined using standard interview techniques according to:

- the instrumental role – the significance of rivers, lakes and coastal environments as a source of physical health (specifically nourishment); and

- the hermeneutic role - the ways in which kai awa, kai roto and kai moana give meaning to the lives of whanau and hapu. Contemporary research seldom examines the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana, which when communicated to policy makers in the absence of empirical data, are often dismissed as anecdotal. Finally, kai awa, kai roto and kai moana (and the waterbodies from which they are sourced) are examined in terms of their cultural embeddedness of whanau and hapu.

All of those interviewed for this research expressed a strong relationship with the lakes the wider terrestrial and marine surroundings. Whakapapa, ancestral connection to the lakes area and ahi karoa remain significant elements of the relationship. Two thirds of the participants spent their childhood in South Canterbury (within the takiwa of Te Runanga o Arowhenua) while two of the participants grew up in the North Island.

A large variety of kai continues to be regularly collected, gifted, purchased and/or consumed. While whanau continue to gather a range of species, it is considerably less than the 38 species that we know from manuscripts were historically obtained from these sites across South Canterbury. Although some resources were gathered seasonally, historically whanau relied on freshwater resources year round. The principal purpose of the Kai Consumption Survey was to determine the extent of gathering by whanau living in the South Canterbury region. Consistent with a kai gathering lifestyle:

- 78.5% grew their own vegetables.

- Of the 78.5%, 57% of those who grew vegetables also grew fruit.

Having determined that all of respondents do consume different types of kai:

- 40% of respondents said they now only eat kai on special occasions; while

- 18.9% eat kai less than once a month; and

- 22.3% eat kai 1-3 times per month.

In other words 81.2% eat kai 1-3 times per month or less.

In addition to identifying the species gathered, the sites from which kai was sourced were identified. These sites were then used as the basis for a sampling programme which examined contaminants in sediment and kai. Kai was gathered from 13 waterbodies across the region. Approximately 47% of

participants gather from the Temuka River, while the Opihi River (upstream of State Highway 1, downstream of the State Highway, and the river mouth) is used by 30%, 28% and 37% respectively.

If kai moana, kai awa and kai roto are to be promoted as a beneficial source of food for whanau, there need to be sufficient quantities of healthy stocks in order to sustain gathering. Questions in the Kai Consumption Survey asked whanau to provide their assessment of the stocks of various species gathered. Of concern, 54% of respondents believed that across all species gathered there were now a "lot fewer" available while another 17.9% believed that abundance was "slightly fewer".

Whanau were asked to identify their preferred kai. Surprisingly, the top 6 preferences according to the ratings (in order of preference) were:

1. snapper, koura
2. kina
3. trout
4. pupu, pipi, cockles, herrings, oysters.

There is little data available to enable calculation of pre-European contact per capita consumption of kai. Even if it was possible to determine harvesting levels for particular species, it is difficult to calculate how much food (and what species) on top of this would have been received as a gift or obtained through trade. For the calculation we assumed that historically wild sourced kai would have been consumed on average once per day. From interviews we know that wild sourced kai was consumed "at least 3 times" per week in the 1970s and 1980s. Some whanau, however, eat kai daily. However a crucial time period – around the 1970s and 1980s – marks a significant change in the quantity of kai consumed as interviewees confirmed that more convenience foods started to appear in whanau diets. From the interviews this coincides with observable deteriorations in the health of aquatic habitats. Again to enable a calculation of kai consumption in the mid twentieth century we have assumed kai was consumed 3 times per week.

With respect to contemporary consumption, from the Kai Consumption Survey, all respondents still consume kai awa, kai roto, or kai moana. The quantities available fall far short of historic levels and the levels desired by whanau who wish to engage in mahinga kai practices, although they exceed average New Zealand consumption rates (32.87g per person per day).

Kai consumed historically	Equals 230.77 per person per day
Kai consumed up until 1970s &1980s	Equals 98.63g per person per day
Kai consumed today	Equals 43.81g per person per day

Part of the reduction in quantities consumed can be attributed to environmental degradation. A species will show signs of dwindling for a while and then suddenly decline because its population is no longer self-sustaining.

Major changes in mahinga kai gathering behaviours began some 160 years ago with European settlement. Newly introduced foods replaced wild sourced kai principally because of the relocation of whanau and hapu to reserves, their assimilation into mainstream New Zealand culture, and damage to the resource base resulting from use and development of resources by the newly arrived settlers. Interestingly many of the sites still utilised by whanau are found in close proximity to reserves and easements.

Although the initial loss of land occurred in the mid eighteenth century the interviews with whanau members (especially kaumatua) confirmed that they gathered many species until relatively recently and they believed that the most damaging changes occurred within the last generation. These observations confirm the period of 1970-1980 as a time of change.

The alienation of lands and resources has seen the mahinga kai practices of Ngai Tahu transformed. This transformation occurred at a time when resource degradation and environmental crises have precipitated the search for alternatives to dominant management systems (Berkes, 1991, 1994; Pinkerton, 1989). Traditional knowledge (or in the New Zealand context Matauranga Maori) is increasingly promoted as a valuable addition to scientific knowledge. However it must be recognised that the application of Matauranga has been disrupted and subject to interference. Nevertheless for some whanau, for some resources, in some areas, there has been regular, relatively uninhabited resource use through the generations. As the interviews and Kai Consumption Survey show many Ngai Tahu continue to gather and consume kai awa, kai roto and kai moana.

The fact that kaumatua contend that the most damaging changes have occurred in the current generation when considered alongside the data showing that the 10% of respondents who don't eat kai are all rangatahi suggests the assimilation of Maori into mainstream New Zealand lifestyles and diets is continuing and that the loss of some mahinga kai practices may be quite marked in younger whanau members.

In South Canterbury, the declining abundance of aquatic species at many sites across Canterbury is attributed to water quantity issues arising because of excessive extractions, changes in flow patterns as a result of damming, and demands to divert or drain waterbodies. This clearly has the potential to place Ngai Tahu in confrontation with development interests as:

- The streams valued and utilised by Ngai Tahu are those most stressed.
- Currently 88% of water allocated in Canterbury is used for irrigation.
- Ngai Tahu believe some of the current land uses (that are totally dependent upon water supply) are unsustainable.

Interviewees believed that summer withdrawals leave some stretches of riverbed almost dry. The water is left dribbling in channels and gets lethally warm and polluted with agricultural runoff. Fish migration – upstream and downstream – is also severely compromised. In some catchments fish

survival is dependent on access to isolated and disconnected large pools. Of particular relevance to consideration of contaminant levels, is the reduced assimilative capacity of waterways when only minimum flows are maintained – often for significant periods of time during summer.

More recently Ngai Tahu have been denied access to kai due to increased gathering pressure by ethnic groups who either do not know or respect the tikanga and/or rules that regulate gathering.

Despite the level of environmental change and the potential for contamination, it needs to be acknowledged that lifestyles today leave little time for fishing activities.

Changes to the health of the waterbodies and consequently the relationship of whanau with aquatic resources have resulted in a range of health and wellbeing implications for Ngai Tahu whanui. Although the implications emerge from the data they are quite subtle with some informants describing the effects without explicitly "labelling" it as an effect. However, despite this, the links between aquatic resources and health and wellbeing are evident in the sense that they are 'just below the surface' for many of the participants. It is possible that because the themes presented are widespread amongst the interviewees they are also widespread amongst the rest of the hapū, especially the older members who have experienced a lot more of the changes presented in this report first-hand.

1. Introduction

1.1 Background

Waterbodies impacted by pollution and suffering environmental degradation represent a risk to the health of both aquatic organisms and humans. Even at low concentrations contaminants, particularly organic compounds, can cause long-term impacts and pose significant risks to the health of biota and humans. In the aquatic environment, contaminants transported by the air and in the water are highly likely to be deposited in sediments, where in turn, fish and shellfish are exposed. Contaminants are generally stored in the lipids of biota and can be biomagnified up the food-chain. Human health may be threatened either by the direct consumption of fish and shellfish contaminated with pollutants, or by direct exposure (via water and atmosphere during collection) to them (Boesch and Paul 2001).

Concerns about the potential accumulation of contaminants in fish and other wildlife, which commonly form a component of indigenous peoples' diets, and their consequent potential effects on human health, has led to a worldwide proliferation of studies examining the effect of environmental contaminants on fish, wildlife and communities. For example, leading international indigenous contaminant research programmes, e.g., the Northern Contaminants Programme (NCP) and the Effects on Aboriginals from the Great Lakes Environment (EAGLE) Project were established in response to concerns regarding the exposure of humans to elevated levels of contaminants in the traditional subsistence diets of indigenous peoples. Research to date has shown that certain indigenous communities have elevated contaminant levels due to exposure through their traditional diet (Hoekstra et al., 2005; Johansen et al., 2004; Odland et al., 2003; Van Oostdam et al., 1999; Van Oostdam et al., 2003). In addition, fish and wildlife are used as indicators of the health of the ecosystems.

The impact of environmental contamination on the resident "wild kai", and in turn, on Māori iwi/hapū consuming them, has not been investigated to date. A recent review of wild food in New Zealand identified gaps in knowledge of contaminants in non-commercial wild-caught foods, especially in terms of consumption levels (and hence exposure) (Turner et al., 2005). A resulting draft position paper identified a need for information and education on contaminants in kai (NZFSA 2005). In response, the National Institute for Water and Atmospheric Research (NIWA), in conjunction with Tipa & Associates and iwi research partners, Ngāti Hokopu ki Hokowhitu, Te Arawa Lakes Trust and Te Runanga o Arowhenua initiated a programme of research to investigate the contaminant levels and risk to Maori health associated with 'wild kai' – food gathered from the sea (kai moana), rivers (kai awa), and lakes (kai roto). This research, funded by the Health Research Council over a three year period, ultimately

aims to improve Maori health by identifying, quantifying, and effectively communicating the risks associated with the collection and consumption of wild kai.

1.2 Research Rationale

Traditionally, Maori had their own knowledge systems of how the environment contributed to health and well-being. Wild kai, gathered from the sea, rivers, and lakes, has always been an integral component of Maori lifestyles, but today is increasingly susceptible to contamination. The impacts of environmental contamination in wild kai on Maori have not been investigated to date. The present research sought to address this shortcoming.

As part of the first phase of the research, Maori from three communities were asked to identify species, locations and quantities of kai moana, kai roto and kai awa consumed. This was to enable the levels and types of contaminants in the kai to which Maori are exposed to be determined.

While it could be argued that contamination of wild kai has the potential to directly impact the physical health of Maori, the impacts of contamination and/or loss of an important cultural activity on wellbeing have also been explored during the course of the project. Maori associate their well-being as individuals and as members of whanau, hapu and iwi, with maintaining the health of the natural environment (Durie 1994, 1998, Panelli and Tipa 2007, 2008). Maori strongly believe that the whenua and tangata are inextricably intertwined, and when one of these becomes unbalanced, the other equally suffers (Harmsworth and Warmenhoven 2002; Sims and Thompson-Fawcett 2002). Therefore, the sustainability of the natural environment and the long-term well-being of Maori are seen by some Maori as one and the same thing (Panelli and Tipa 2007). This is consistent with conceptualisation of wellbeing proposed by other indigenous communities (Adelson 2000, Greiner et al., 2005, McLennan 2003, McLennan and Khavarpour 2004, McGregor et al., 2003). Customary and recreationally gathered "wild kai" resources are therefore of significant cultural, recreational and economic importance in both traditional and contemporary Maori society (Waitangi Tribunal 1983, 1984, 1987, 1988, 1989, 1991, 1992, 1995, 1998)[1].

The majority of the international research in the area of contaminants in the traditional diets of indigenous peoples has primarily focused on the levels and health effects of exposure to heavy metals and organochlorine contaminants through the consumption of marine fish and mammals in peoples from the northern hemisphere, i.e., the Inuit people of northern Alaska, Canada and Greenland (Hoekstra et al., 2005; Johansen et

[1] The evidence submitted to the Tribunal by Iwi, and the summary reports from the Tribunal itself provide a graphic depiction of the significance of gathering kai for whanau, hapu and iwi.

al., 2004; Odland et al., 2003; Van Oostdam et al., 1999). Research to date has shown that certain Inuit communities have elevated contaminant levels (e.g., mercury, lead and chlordane) due to exposure through their traditional diet (Van Oostdam et al., 2003).

It is unlikely that contemporary Maori communities have been exposed through their diet of "wild kai" to the levels of organochlorine contaminants as high as those observed in indigenous populations residing in the northern hemisphere (due to occurrence of large mammals in the customary diet of Inuit). However, the impact of environmental contamination on the resident "wild kai" and, in turn, on Māori iwi and hapu consuming them, has not been investigated to date. In addition, while existing consumptive advice is available for some species of relevance to Māori, this advice is based on average national consumptive patterns and doesn't account for potentially higher consumption rates of specific traditionally harvested foods by Māori, with its concomitant elevated exposure risk. Māori utilise kai from rivers, lakes and the oceans (as well as the land).

This research aims to identify and communicate the risks posed by the presence of environmental contaminants in the kai moana, kai roto and kai awa to the Maori communities that gather these resources. Major outcomes of the research will be development of a generically applicable risk assessment framework, and Maori-targeted risk communication strategies. It is envisaged that the research will be of interest to the wider Maori community, non-Maori, public health providers, as well as indigenous peoples worldwide for whom fish and shellfish constitute a major part of their diets.

1.3 Research aim

The overall aim of our research project is:

> *To determine to what extent locally available kai moana, kai roto, kai awa, and the associated aquatic environments pose a health risk to tangata whenua.*

Successful frameworks for undertaking research in a manner that is culturally acceptable, and which ensures the protection of intellectual property rights, were developed between NIWA and Ngāti Hokopu and Te Arawa during the HRC and FRST funded programmes 'The Revitalisation and Enhancement of Matauranga Hauora of Aquatic Environments (C01X0226)' and 'Sustainability and Management Framework for Te Arawa Lakes' Customary Fisheries (CO1X0305)'.

Memoranda of Understanding between NIWA and Ngāti Hokopu ki Hokowhitu, Te Arawa and Te Runanga o Arowhenua have been established to formally record the expectations of conduct between NIWA and the respective parties with respect to the present research.

Three Maori communities were involved in the overall research:

- Te Arawa: centred around the Rotorua Lakes;
- Ngāti Hokopu ki Hokowhitu: centred around Whakatane; and
- Te Runanga o Arowhenua: centred on South Canterbury.

These communities were selected on the basis of previous contact (and research projects underway) with key researchers. Permission was obtained and confirmed by a sub-contractual agreement.

The three communities differ in their access to and use of aquatic resources. Each community is characterised by different physical, natural, social and political capital which directly impacts the level of kai awa, kai roto and kai moana gathered and consumed. In each region the diversity of aquatic ecosystems utilised, with spatial and temporal patterns of gathering unique to the each place and community, reflect a history of complex, locally specific tikanga and kawa driven behaviours. Exploring the complexity of this inter-community variation was beyond the scope of this research.

There are four main stages to the research project:

1. Objective 1: The first stage involves interviews with key informants and undertaking a survey to identify what kai moana species are harvested and eaten by iwi/hapu members from Ngāti Hokopu, Te Arawa and Te Runanga o Arowhenua, and the aquatic environments they are currently sourced from.

2. Objective 2: The second stage identifies the types and levels of contaminants present in the “wild kai” and associated habitats identified by Maori.

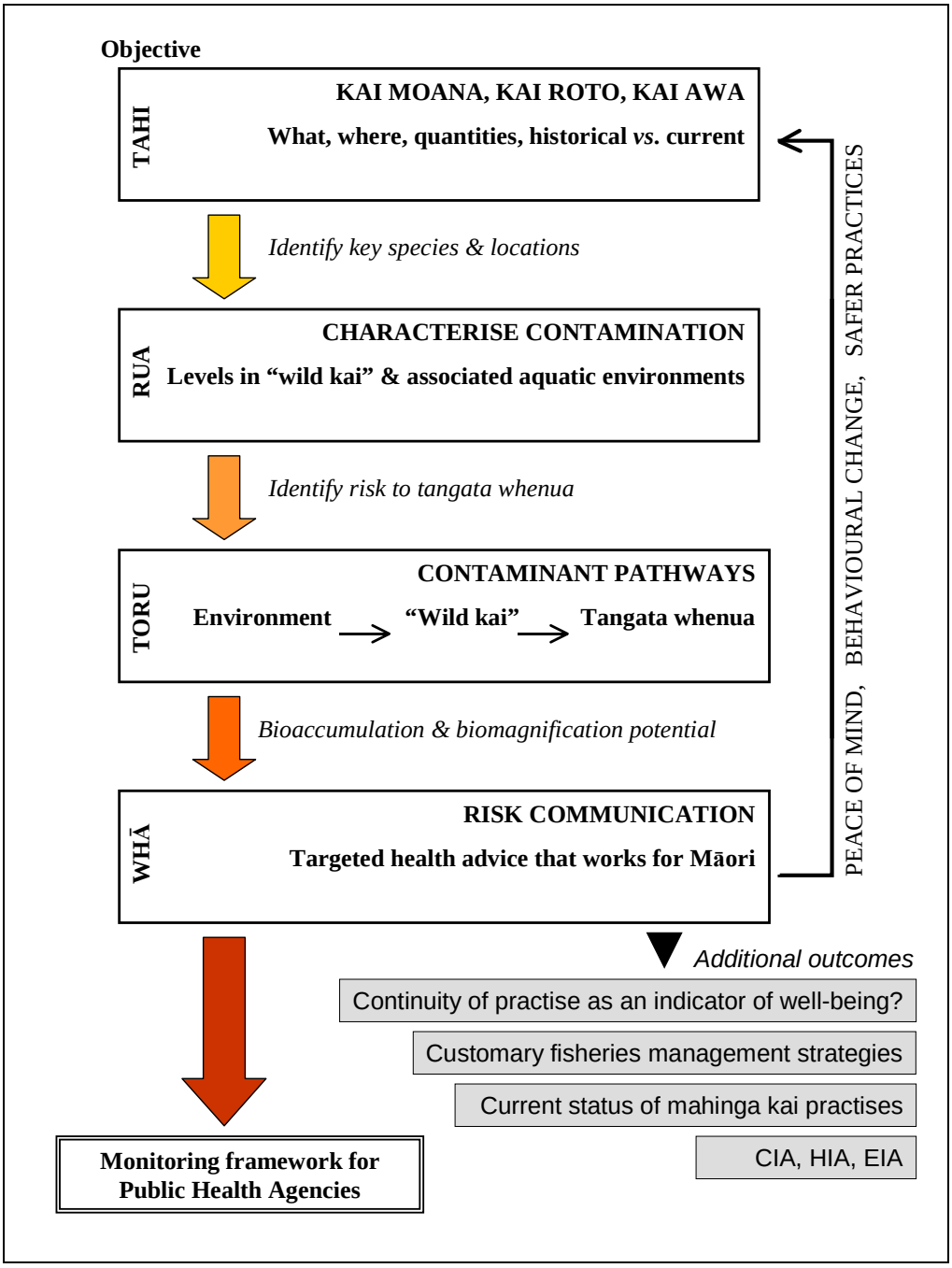
3. Objective 3: This stage establishes potential pathways of contaminant bioaccumulation via the food web utilising methyl mercury as an example of a bioaccumulative contaminant.

4. Objective 4: This stage identifies the potential health risks associated with the collection and consumption of contaminated “wild kai”, and develops risk

consumption advice specifically targeted at Maori, that will take into consideration both the benefits and risks associated with eating kai moana, kai roto and kai awa.

Figure 1 provides a graphic representation of the identified research priorities, the objectives, and possible outputs.

Figure 1: Research priorities, the objectives, and possible outputs.



The first objective of the research (to provide a description of the kai moana, kai roto and kai awa collection, processing and consumption patterns of iwi/hapu members) is clearly a precursor to Objectives 2–4. This first stage identifies:

- What types of kai have been collected and/or eaten in the last 2–3 generations (e.g., species, life-stage, abundance)?
- Where were/are they harvested from and when (e.g., location, ecosystem, season, time of day, life-stage)?
- How is kai moana stored and processed for consumption?

This report documents the results of the first phase of the above research programme, specifically investigating the level of kai consumed by whanau in South Canterbury and the potential effects of environmental contamination on their physical, spiritual and cultural well being.

To elicit the data needed we included methods that have been used previously with hapu around New Zealand. This approach consisted of focus groups and hui, followed by interviews. For this objective it was important to assemble a group of willing participants with knowledge and experience of kai gathering in the takiwa (area) and rohe.

1.4 Report Structure

This report has been divided into a number of sections:

Section 1 Sets out the background and the aims of this study.

Section 2 Describes the methodology that was used.

Section 3 Provides some information on Te Runanga of Arowhenua and their takiwa in South Canterbury region.

Section 4 Outlines international developments within which the research is situated, specifically:

4.1 indigenous communities and participatory approaches to management and research;

4.2 contemporary wellbeing research, and implications for this study;

4.3 international observations of the impact of changing diets;

4.4 effects of contaminants on health;

4.5 Maori conceptualisations of health and wellbeing.

Section 5 Introduces the empirical analysis by outlining the quantitative research results; specifically with respect to contemporary patterns of gathering. This chapter is informed by the Kaimoana Consumption Survey.

Section 6 Based on the results, develops a broader understanding of the importance of kai awa, kai roto and kai moana within the wider socio-economic-cultural activities of whanau and hapu. It provides a brief comparative analysis by discussing the contemporary patterns alongside historic traditional patterns. It pulls together the qualitative and quantitative research results and identifies main themes that are then discussed in the context of international literature.

Section 7 Returns to the original kaupapa of the research and discusses the next steps in the research process. The report concludes with observations of how social, cultural and political meaning associated with kai gathering could inform the management of such resources within the community.

5.1 historic, traditional patterns of gathering;

5.2 changes to traditional lifestyles; and

5.3 contemporary patterns of gathering.

Section 6 Then moves away from presenting the quantitative results to develop a broader understanding of the importance of kai awa, kai roto and kai moana within the wider socio-economic-cultural activities of whanau and hapu. It reflects and pulls together the qualitative and quantitative research results in the context of international literature.

Section 7 Returns to the original kaupapa of the research and discusses the next steps in the research process. The report concludes with observations of how social, cultural and political meaning associated with kai gathering could inform the management of such resources within the community.

2. Methodology and Data Analysis

There is growing recognition of the significance of aquatic habitats and the resources found within them that sustain indigenous communities. Yet this recognition has not been accompanied by investigations to increase understanding of the specific contribution of aquatic habitats and resources to the health and wellbeing of communities depending on these resources.

Drawing on the earlier work of Bebbington (1999), importance to whanau was examined according to:

- the instrumental role – the significance of rivers, lakes and coastal environments as a source of physical health (specifically nourishment); and

- the hermeneutic role - the ways in which kai awa, kai roto and kai moana give meaning to the lives of whanau and hapu. Contemporary research seldom examines the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana, which when communicated to policy makers in the absence of empirical data, are often dismissed as anecdotal. Finally, kai awa, kai roto and kai moana (and the waterbodies from which they are sourced) are examined in terms of their cultural embeddedness of whanau and hapu.

This section of the report outlines the methodology employed, but starts with a description of the Maori community studied.

2.1 Study area

As previously stated, this report details the results of one case study: Te Runanga o Arowhenua. Participants living in South Canterbury were recruited from Te Runanga o Arowhenua members. Availability to take part in the research was the only exclusion criteria, although the preference was for key informants to be active kai gatherers. The study was undertaken under Ethics Approval MEC/07/07/088 and all participants gave written informed consent.

2.2 Methodology

The research team utilised two research methodologies to contrast the instrumental and hermeneutic role of aquatic resources as a source of kai awa, kai roto and kai moana. The first was a quantitative survey of wild kai consumption using a questionnaire, while the second incorporated participatory research techniques via a focus group and a series of qualitative interviews.

The survey followed once the interviews were complete. This was to ensure that the sites and species about which data was sought in the questionnaire were identified by the hapu, and not predetermined by researchers.

2.3 Quantitative survey - Kaimoana consumption survey

The Kaimoana Consumption Survey questionnaire was adapted from a range of other studies (including diet surveys, fish consumption surveys, traditional use surveys, surveys of the health of indigenous communities and perception/preference surveys). The survey questionnaire was approved as part of the Ethics Committee approval process.

2.3.1 Kaimoana consumption: quantifying importance of sites and species

We examined consumption using a food frequency questionnaire with frequency categories ranging from less than once per month to one or more times per day. Consumption is one of the principal means by which the importance of kai awa, kai roto and kai moana and the intimate and dependent relationship with aquatic environments from which they are sourced can be determined.

2.3.2 Existing estimates

Kaimoana consumption records in New Zealand are sparse. Estimates were derived using data from the questionnaire by calculating the amount consumed and the frequency of consumption.

2.3.3 Seasonal variation

Some species of kai awa, kai roto and kai moana are seasonal resources while others are open access. Seasonality is explained in historical literature recognising that tikanga and kawa was attuned and responsive to the life-cycle of the different species. Therefore, questions in the survey identified where possible seasonal patterns of contemporary gathering.

2.3.4 The impact of kai awa, kai roto and kai moana on whanau and hapu livelihoods

Arguably there is a need for a broader understanding of the importance of aquatic resources as a source of kai beyond the simplistic statements of mahinga kai that often accompanies ecologically based descriptions of aquatic ecosystems. The questionnaire sought to address this need by analysing the complex relationship that whanau have with waterbodies found in their takiwa.

2.3.5 Other

Other data gathered included:

1. demographic information, such as the prevalence of certain medical conditions, lifestyle factors including risk-related behaviours, and family history;

2. self-reported heath status using a generic, health-related quality of life questions;

3. kai gathering locations; and

4. perceptions held by whanau members about the importance of aquatic ecosystems and species, and their assessment of the health of these resources.

2.4 Qualitative methods

The qualitative methods used here address the first of the research objectives as stated in Section 1.3 above. Methods involved an introductory hui, a focus group session, follow-up interviews, informal discussions with many people and reviewing secondary data sources (documents).

2.4.1 Literature review

An examination of relevant literature was undertaken for five reasons

1. to provide a more comprehensive understanding of historical resource use and patterns of activity in the study community;

2. to gain an appreciation of the changes to the aquatic habitats over time, as perceived by participants;

3. to identify the changes over successive generations that have impacted on kai gathering behaviours;

4. to understand the aspirations of Te Runanga o Arowhenua to address issues of concern with respect to waterbodies; and

5. finally, to ascertain if and how agencies have responded to the stated aspirations of participants.

Qualitative data were collected from published and unpublished documents, from libraries, the Waitangi Tribunal (evidence to the Tribunal and reports from the Tribunal), statutory and iwi plans, and statutory planning documents. Internet searches also yielded further material.

2.4.2 Participatory methods

Before working with Te Runanga o Arowhenua, an introductory presentation was given at a monthly runanga meeting during which the participatory process was outlined. Two participatory methods were incorporated into the research: a focus group and interviews with key informants. At the start of all interactions (focus group and interviews) the roles and obligations of participants and researchers were discussed.

Focus group

A focus group was convened at Temuka in April 2008. Seven participants attended the focus group. The participants were engaged in a guided discussion lasting 1–1.5 hours. The focus group followed the framework of questions presented in Box 1. This second session focused on gaining a broad understanding of the spatial extent and description of aquatic resources from which kai awa, kai roto and kai moana were sourced, and the overall importance of each waterbody and species to whanau and hapu. Maps were used to record information about species, locations and other relevant information. Discussions of the focus group were taped.

In depth semi-structured interviews

In the weeks following the focus group meetings, follow-up interviews were conducted. The purpose of these interviews was to collect additional and more detailed data related to the location and types of kai collected and consumed, and factors that may have influenced gathering. Interviews also covered preparation technologies and processes, and specifics about consumption. The questions used for the focus group were also used to guide the interviews that probed more deeply into the personal experiences, thoughts and feelings of the individuals. The intention was to identify and explore the diversity and complexity of relationships and gain a comprehensive understanding of the changes to aquatic environments and the emergent issues seen as potentially impacting health and wellbeing as perceived by different individuals. Interviews were carried out with 10 individuals resident in South Canterbury. Each interviewee was identified by Te Runanga o Arowhenua.

BOX 1: QUESTIONS AT THE FOCUS GROUP & INTERVIEWS

Species of kai

- What (species of kai) did you gather when you were young?
- What places can you remember visiting to gather kai when you were growing up?
- Did you collect year round or seasonally?
- Can you recall any places that you were told not to go to for kai?
- Were there any times / occasions that you were unable to gather kai?
- How long did it take to gather the kai that you needed?
- What (species of) kai do you gather today? What places do you use today?
- Do you gather kai year round or is it seasonal?
- What events / conditions etc. stop you from gathering kai?
- How often would you or someone in your whanau go out to gather kai?
- How long does it take to gather kai compared to when you were younger?
- What species / sites have you lost over the years? When and why did you stop using them?

Behaviours with kai

- Is kai shared? With whom? Has this changed over your lifetime?
- How was kai prepared? Has this changed?
- What methods are used to collect kai? Has this changed?

Condition of kai

- What quantities were taken when you were younger? What quantities are taken today?
- What was the condition of the kai when you are younger? How does this compare with what is taken today?

Observed and known changes

- What changes to the experience of gathering kai h you observed? How has this affected you and your whanau? How have you adapted to these changes?
- What changes to the habitats have you observed and how have these affected you?
- What sort of things would you like to see happen in the aquatic environment you associate with and why?
- Are you happy with your current level of access to kai that you value? What are the main barriers you face today?

Wider benefits of gathering kai

- What do you like about being able to go and gather kai?
- When you gather kai are you with other whanau or hapu members?
- What rules or beliefs do you follow with respect to gathering kai?
- Do you feel any special attachment to the places from which you gather your kai?

Health risks

- Do you know of any health risks associated with gathering kai?
- If you were told not to gather kai from an area because of the health risks would you still gather from there?
- What type of information would you need to help you decide whether to gather kai from an unsafe site?

Informal interaction

It must be noted that the formal methods were augmented by many instances of informal discussion, as is the case in most qualitative research.

There were two principal outputs, the first being a map documenting the types, locations, and quantities of kai moana collected and consumed by those present. This was complemented by an analysis of discussions concerning when gathering was undertaken, and the processes used to prepare the kai.

2.5 Qualitative data analysis

In summary, informants were interviewed and interacted with in different forums, and their written documents (both historic and contemporary) and submissions provided further context for interpreting their values, practices, activities and concerns. Accessing multiple sources of data was one of the methodological tools employed to ensure the validity of data collected.

Lincoln and Guba (1985, 224-225) contend that the role of data analysis is "to 'make sense' of the data in ways that will, first, facilitate the continuing unfolding of the research, and second, lead to a maximal understanding of the phenomenon being studied in its context". There were two aspects to the data analysis:

1. firstly to identify sites and resources to be sampled for analysis of contaminant levels; and

2. secondly, the analysis involved identifying, sorting and grouping data from very detailed individual transcripts to identify key themes. The methods of data collection resulted in a considerable quantity of raw data being gathered, and data from a variety of sources had to be systematically analysed.

Data were broken into stand-alone pieces of information, coded and categorised. Categorisation of the data enabled similar themes to be distilled. Some of the themes had been established a priori based on key issues that had emerged while reading related literature and undertaking preliminary discussions when scoping the research topic and negotiating entry to the communities. The question of how to present the data collected from multiple (and mixed) methods was, at times, perplexing. Patterns began to emerge reflecting the diverse nature of the relationship each person had with aquatic habitats, and how and why they believe this relationship has changed over their lifetimes, i.e., how they perceived that these changes have made them feel and behave. Principal categories that were identified represent the headings under which the research findings are presented in sections 5 to 7.

Themes that were distilled from the documentary and interview data were compared with those that emerged from the survey by means of comparative analysis.

It is envisaged that summaries and drafts of this report and the composite report (with the results of the three hapu studies) will be presented and discussed at hui with members of each group.

Before concluding this section it is important to record that the lead researcher for this phase of the research is Ngai Tahu, trained as an environmental manager, employed to advocate in a variety of health and environmental fora for increased recognition of Ngai Tahu beliefs, values and practices, and has worked closely with Arowhenua for a number of years. This must be acknowledged, given the backgrounds from which the participants were selected. There was a possibility that participants gave answers that they thought "she wanted to hear". However by being aware of this possibility, by adopting a disciplined approach to ensure that throughout the data collection and analysis process there was constant referral to the research aims and objectives, and by utilising a range of methods to ensure the research was methodologically sound, the research findings presented in the next section of this report are a fair and accurate interpretation of the data collected.

2.6 Quantitative data analysis

The questionnaire was constructed on Survey Pro 5 (Apian Software Inc) and all data were entered into this programme. The results that are reported in section 5.2 and discussed in section 7 have been produced using the Survey Pro reporting functions. Microsoft Excel was used to construct two of the graphs.

2.7 Summary of methods applied

The methods applied to enable us to understand kai gathering behaviours over different time periods are set out in Table 1.

Table 1: Methods used during the course of the research.

PRE-EUROPEAN SETTLEMENT	19TH CENTURY POST EUROPEAN SETTLEMENT	20TH CENTURY UP TO 1970S – 1980S	PRESENT DAY
Manuscripts	Maori Land Court	Interviews	Interviews
Cultural maps	Land titles for		Review of
Historical texts	Evidence to Royal	Evidence to the	Kai Consumption
Evidence to Royal	Evidence to the Waitangi Tribunal	Photographs	
Evidence to the	Paintings		

3. Study Group

Te Runanga o Arowhenua

The legal identity of Te Runanga o Ngai Tahu is established in the Te Runanga o Ngai Tahu Act 1996. It is the tribal representative body of Ngai Tahu whanui. It is a body corporate, established on 24th April 1996 under section 16 of the Te Runanga o Ngai Tahu Act 1996. Pursuant to section 3 of that Act, "*the Act binds the Crown and every person (including any body politic or corporate) whose rights are affected by any provision of this Act"*.

The members of Te Runanga o Ngai Tahu are the 18 papatipu runanga, each of which is defined in the Act, as is the takiwa for each. Te Runanga o Arowhenua is one such runanga. This establishes who holds manawhenua rights over specific lands and waters within the rohe of Ngai Tahu. Te Runanga o Arowhenua has its offices at the marae at Arowhenua. As one of the 18 papatipu runanga, the takiwa of Te Runanga o Arowhenua, as defined in the Te Runanga o Ngai Tahu Act 1996, centres on Arowhenua and extends from Rakaia to Waitaki, and thence inland to Aoraki and the Main Divide. Figure 2 shows the papatipu marae at which the runanga office is located, while the rohe of Te Runanga o Arowhenua is shown in Figure 3.

Figure 2: The wharenui "Te Hapa o niu Tireni" at the marae at Arowhenua[2].

[2] Photo by Adrienne Rewi http://adriennerewiimagines.blogspot.com/2008_11_01_archive.html

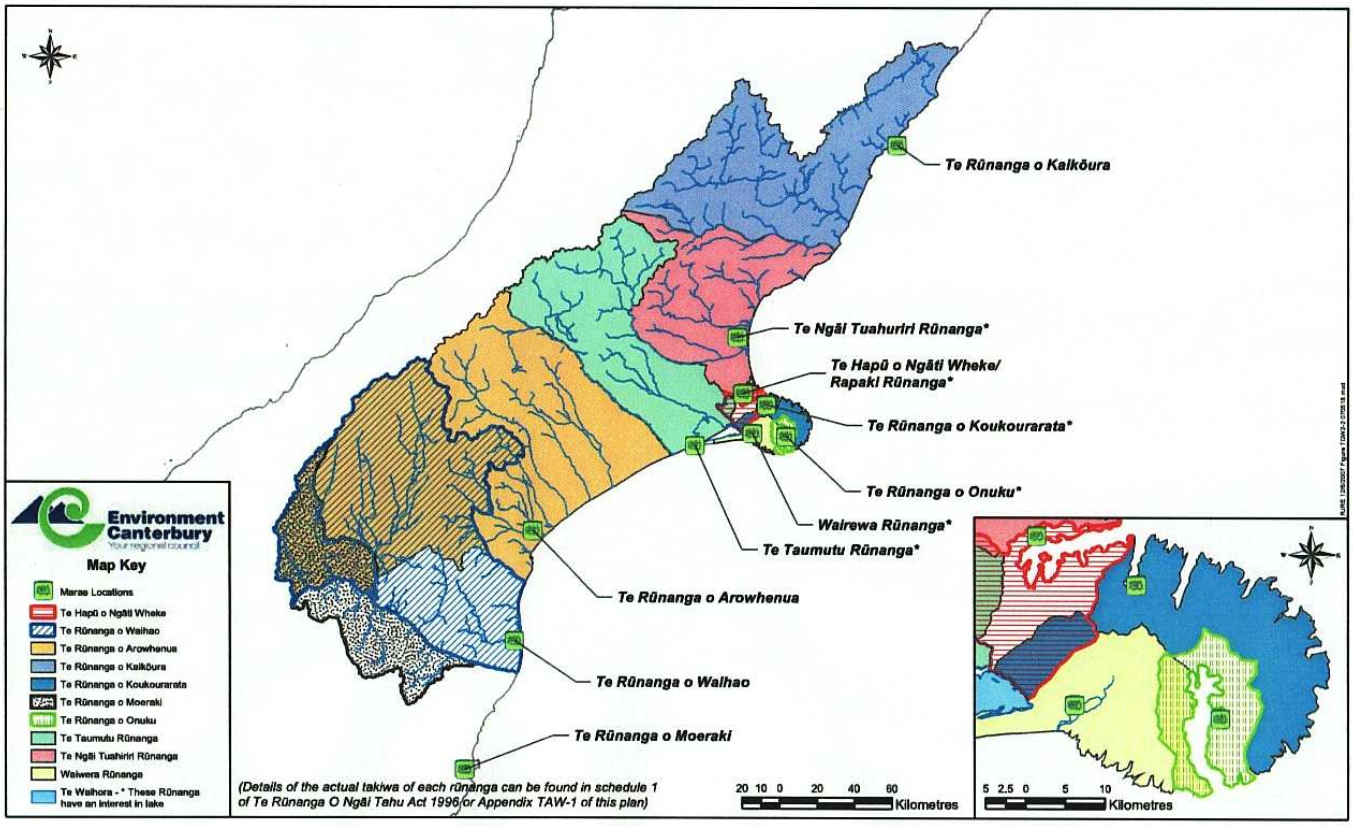


Figure 3: The takiwa of Te Runanga o Arowhenua (Source: Environment Canterbury Natural Resource Regional Plan http://www.ecan.govt.nz/our-responsibilities/regional-plans/nrrp/Pages/read-plan.aspx).

4. International developments relevant to the research

Consistent with the need for the present research to be examined in a context of international literature and academic thought, this section seeks to position the research design and data analyses within contemporary writings from four related areas:

- indigenous communities and participatory approaches to management;
- contemporary wellbeing research, and implications for this study;
- international observations of the impact of changing diets and effects of contaminants on health; and
- Maori conceptualisations of health and wellbeing.

4.1 Indigenous communities and their participation in management

This research sought to utilise participatory research methods. Participation is seen as a means of affording affected parties the opportunity to articulate their interests, enhancing the quality of information available to decision makers; enhancing the potential for support of decisions by enabling early and meaningful involvement; and affecting one's destiny as the opportunity to participate in decisions is a key element of self-empowerment and self-actualisation (Fenge, 1994). In the context of this research project, in addition to collecting environmental contamination data, the wider meanings whanau and hapu attribute to kai awa, kai roto and kai moana are examined, and empirical data collected for use by whanau and hapu.

Participatory approaches to environmental management received emphasis initially in the Brundtland report (WCED 1987) and in Agenda 21, at the 1992 ‘Earth Summit’. Perhaps the greatest significance of these fora lay in the acknowledgement that sustainable development would require new approaches to environmental management, and that effective environmental management would need to be differentially negotiated within individual states, even within individual communities. In effect, this research will also result in a range of cultural values and perspectives of particular aquatic locations being documented and available to each Maori community to inform local processes of management should they so choose.

Pimbert and Pretty (1997) contend that new partnerships and connectedness between different interests is required in environmental management and argue that

participatory processes must be locally grounded which will likely require different solutions for different places. This research will facilitate new participatory processes between environmental managers, public health managers, science agencies and Maori. Despite the increase in participatory initiatives, Pimbert and Pretty (1997) also warn that the call for peoples' participation risks becoming a catch-cry and part of the conventional rhetoric without delivering meaningful outcomes for participants. This warning reinforced the desire of the researchers to deliver a meaningful and effective process for application by Maori and outputs such as those listed in Figure 1 for use by Maori and resource managers.

The drive for greater participation has been paralleled by a concerted drive by indigenous communities to reassert their customary and Treaty rights to access and use land and water resources and greater recognition of the knowledge held within communities including indigenous communities (Western et al, 1994, Pinkerton 1989, 1992, Notzke 1994, Berkes and Folke 1998). Although a range of terms are used, often interchangeably, Berkes (1999) defines indigenous knowledge as that knowledge held by indigenous peoples and traditional ecological knowledge as a subset of that – a practical knowledge of species and beliefs regarding human interaction with the ecosystem. Menzies and Butler (2008) list the attributes of traditional ecological knowledge as cumulative (from long term intergenerational interaction), dynamic (informed by a customary lifestyle but not unchanging), providing a historical understanding of change, local, holistic (viewing all elements as interconnected), embedded (in a unique matrix of local, cultural, historical and traditional elements), moral and spiritual. In order to understand the changes to the diets of successive generations of Maori, the research team was dependent on key informants being experienced and knowledgeable (with indigenous knowledge and/or traditional ecological knowledge) about kai gathering.

Sadly, Maori, like other indigenous communities have witnessed the destruction of valued environments and their alienation from the resource bases upon which their cultures and identities are constructed (Berkes 1991, 1994, 1999). Documenting the changes that have been experienced in South Canterbury and the impacts on whanau and hapu, including a profound sense of loss, was therefore vital.

The growth of interest in the knowledge held by indigenous communities is related to the wider shift within resource management to an ecosystem based management approach (Menzies and Butler, 2003) and recognises that indigenous communities understand the way species interrelate and how ecosystems work as a whole. It recognises that indigenous communities have a well developed understanding of the local environment and their own impacts on local ecosystems. The data collected via the interviews and questionnaire confirmed the proposition of Berkes (1999, page 33) that the "use of traditional knowledge may benefit development by providing more

realistic evaluations of local need, environmental constraints and natural resource production systems".

Initiatives involving the incorporation and/or application of indigenous knowledge are emerging around the world as resource managers seek to engage with indigenous communities. New Zealand has also experienced the drive for greater participation, including greater recognition of the beliefs, values and practices of Maori. In 1991, the Resource Management Act 1991 became the governing legislation for resource use in New Zealand (Davis and Threfall 2006). Two sections are of particular relevance.

Section 6 requires that anyone exercising functions and powers under the Resource Management Act 1991 recognise and provide for matters of national importance including "the relationship of Maori and their cultures and traditions with their ancestral lands, water, sites, *wahi tapu* and other *taonga*" (section 6(e)). Gathering from tribal lands and waters, species that are often accorded the status of "taonga", clearly falls within the gambit of section 6(e) and is thus a matter of national importance.

Pursuant to section 7(a) decision-makers are required to have particular regard to *kaitiakitanga*. The Act presently defines kaitiakitanga as:

> *The exercise of guardianship by the tangata whenua of an area in accordance with tikanga Maori in relation to natural and physical resources; and includes the ethic of stewardship based on the nature of the resource itself.*

The responsibilities of Tangata Kaitiaki are to protect the integrity of resources (including the kai species identified by informants). This requires Maori to focus on long term environmental results, which are likely to include healthy ecosystems with abundant populations of valued kai species that are able to sustain cultural uses well into the future. Despite these encouraging and potentially enabling provisions, often there is little guidance given to managers and regional bodies seeking to meet the obligations to indigenous communities (a challenge Maori confront in New Zealand). This research seeks to produce outputs that will guide both Maori and non-Maori resource managers.

4.2 Contemporary wellbeing research: implications for this study

For indigenous communities food is not just a resource for sustenance as many might understand it in western contexts (Slocum 2007). Rather, Panelli and Tipa (2007, 2008) argue, that food needs to be understood in a wider cultural context that interweaves complex indigenous cultural and environmental relations.

Panelli and Tipa (2007, 2008) contend that to identify these relationships primarily by a particular bio-physical character (e.g., forests, coasts and waterways) misses the range of spiritual, physical, social, material, cultural, economic and political relationships that might be involved in any one case. The complexity of these relationships must be appreciated before the significance of an 'individual' phenomenon or activity (such as food or food gathering) might even begin to be approached (let alone the cultural or health implications of such things). They further contend that to consider kai gathering without this contextual understanding would diminish its cultural value and the rich dimensions that underpin whanau and hapu experiences of identity and well-being. The results of the Kai Consumption Survey reported in subsequent sections of this report support the proposition that individual experiences of interviewees vary as lives are influenced by a complex combination of: cultural beliefs, values and uses; a history of colonization, loss of lands, alienation from their lands, waters and resources; and contemporary interactions with a dominant non-Maori world that is based primarily on capitalist, western values (Panelli and Tipa, 2008). The range of perceptions, preferences and the experiences of members of Te Runanga o Arowhenua that emerged from the analysis of data collected for the present research are set out in sections 5 – 7 of this report.

Indigenous communities have traditionally been resource users and developers (O'Regan 1984, Notzke 1994). They used natural and physical resources for subsistence (physical survival) and sustenance (spiritual survival). Internationally there are calls to recognize and protect cultural knowledge and practices that are 'fundamental for food security and well being' (FAO 2007). Gombay (2005: 418) explains the significance of this stance, and when describing the Inuit argues that when they:

> *hunt, fish, or gather food the material and immaterial worlds blend together, with layer upon layer of meaning and understanding. The getting of country foods is about understanding the land in which one lives. It is about building an awareness and knowledge of one's place in the natural world ….*

The gathering, exchange and consumption of kai are also significant cultural activities for Maori. Complex associations with the environment and mahinga kai have developed over centuries and include social, economic, psychological, spiritual and physical dimensions that are an intrinsic part of health and well-being of whanau members. Diversity is wide (as evidenced by the individual variation from the survey results) but this is considered acceptable within whanau and hapu. The data collected helps explain how sourcing kai from lands and waters reaffirms firstly, connectedness with the lands and waters to which one has whakapapa, and secondly ensures continuity of practices initiated and valued by tupuna. In the Ngai Tahu context, mahinga kai practices also enable social and environmental responsibilities to be

fulfilled. To be denied the opportunity to manaaki visitors to one's home and marae would have consequential adverse effects on the health and well-being of Maori – a point that may be experienced beyond the individual and whanau level.

4.3 Maori conceptualisations of health and wellbeing

Durie (1994) introduced *Te Whare Tapa Whā* - a four sided house - or the four cornerstones of health; these being: *hinengaro* (mental well-being), *wairua* (spiritual well-being), *whanau* (family well-being) and *tinana* (physical well-being) which was subsequently adopted by the Ministry of Health (2006). Durie (2004) then proposed a second conceptualisation, *Te Pae Mahutonga*, which he contends represents the fundamental components of health promotion - *Mauriora, Waiora, Toiora* and *Te Oranga*. He explains that: *Mauriora* is dependent on a secure cultural identity; *Waiora* refers to healthy air, land and water environments which requires a balance between use and development and protection; *Toiora* focuses on personal behaviours and responsiblities; and *Te Oranga* recognises that health promotion (in particular increasing well-being) requires increased participation by Maori in societal affairs.

Another conceptualsation, by Pere (1997) emphasises reciprocity and interconnection between individual selves and wider social interests. In this sense, each experience of well-being would vary from place to place reflecting *whenua* (earth), *turangawaewae* (standplace), *whanaungatanga* (kinship), *whanau* (family), *wairua* (spirit), *hinengaro* (mind, heart), *whatumanawa* (feelings) and *tinana* (body). This conceptualisation by Pere helps explain connections between specific understandings of *whenua* and the social and cultural relations developed in particular places.

Panelli and Tipa (2008) explain how many Maori express a strong affinity for the earth and adhere to basic principles regarding their relationship with other aspects of creation and quote Crengle (2002) who explains all parts of the environment are related to one another and exist within a mutually inter-dependent whole. Deriving economic or social benefit from resource utilisation (recognised as contributors to wellbeing), must be carefully balanced.

Initiation of the current research programme and exploring the contribution of kai gathering to health and wellbeing is predicated on the belief that understandings of health and well-being can be enhanced by explicit conceptualisations that align spiritual, social and cultural elements in connection with bio- physical bases.

4.4 Effects of contaminants on health

While some agencies and researchers contend that people everywhere are exposed to chemical contaminants in the environment, international studies confirm that the majority of exposure to contaminants comes from food, with the consumption of contaminated fish identified as the largest single source of exposure in Canada (Health Canada 1997). Of concern, fish constitutes a significant dietary source of protein for many populations worldwide, especially indigenous communities.

Traditionally, the diet of many indigenous communities (including Maori) consisted of fish, game, waterfowl, and plants sourced from local lands, waters and coasts. Contemporary diets, in contrast, are likely to be a combination of traditional food items and more easily accessed commodity or convenience foods. Despite the change to convenience foods, traditional foods continue to underpin cultural identity for many indigenous communities. Delormier and Kuhnlein (1999) explain how changes experienced by Eastern James Bay Cree have affected diet, traditional food use, and nutrition. They contend that the reduced use of traditional food by younger generations, changes in fish consumption as a result of contamination, and increased incidence of obesity, diabetes, and cardiovascular disease within communities, represent particular socio-cultural concerns. Exploration of these issues and the longer term impacts has necessitated examination of the current diet and food consumption patterns of the Cree. The nature and extent of the risk that Maori confront in New Zealand is unknown but this research attempts to assess the risk.

If food is a major route of human exposure to many persistent toxic environmental contaminants the present research hypothesised that the consumption rates of aquatic species by Maori could represent a significant risk of exposure given their potential higher rates of consumption of these foods. The information gathered through the interviews and the questionnaire therefore had to enable the research team to establish whether there were any correlations between the contaminant levels measured in the participants' tissues (hair) (a separate component) and the fish or shellfish species they consumed in the past year. While such a relationship could not be considered as defining a direct cause:effect relationship, it would increase our understanding of the possible exposure risk to tangata whenua. We have also developed a model of potential contaminant accumulation pathways between participants and the kai they consume and calculation of relative risk, based on measured contaminant levels in kai species, their associated environments and consumers. Furthermore, the data had to enable the research team to assess the levels of contaminants in the respective fish and shellfish species consumed, by identifying important species and harvesting locations. These data were subsequently used to develop a sampling plan for kai species and associated environmental parameters. The results of these strands of research are to be presented elsewhere.

In risk management, the focus is on ensuring that mitigation strategies are culturally appropriate yet rarely are Maori perspectives or knowledge explicitly included in determining the hazards or health outcomes to be considered in the risk assessment. In the absence of explicit procedures to apply health risk assessment in Maori communities, the data derived from the questionnaires and interviews will contribute to the development of a health risk assessment model. Again using data gathered from this stage, we will develop Maori-focused guidelines with respect to the consumption of wild sourced kai and will also explore the appropriateness of existing information dissemination tools for effectively communicating risk.

5. Research results

In this section of the report we start by providing a description of the mahinga kai practices of whanau and hapu across South Canterbury prior to European settlement before profiling the present day behaviours of whanau members and highlighting changes from traditional lifestyles. Although challenging, we also seek to identify causes for the changes. The information relating to traditional practices is extracted from secondary data sources (including tribal manuscripts). Interviews with whanau members and the Kai Consumption Survey provided the data from which the contemporary profile was constructed.

5.1 Traditional patterns of gathering

From the oral histories of Ngai Tahu and written manuscripts, descriptions of a stable mahinga kai based lifestyle emerges. Evison (1993) describes how the great number of plants, birds, and fish that comprised the food sources of Ngai Tahu assured always that somewhere, something was available to eat. An outstanding characteristic was the sequential utilisation of a variety of natural resources from widely dispersed localities mirroring the cycles of rivers and species (Dacker 1990, Anderson 1988, 1998). This pattern of resource use shaped an itinerant lifestyle where mobility was pronounced and essential.

Movement and an understanding of the resources available over a wide territory were therefore crucial for sustaining the livelihoods of Ngai Tahu whanui prior to European settlement (WT[3], 1991, J10:99). Anderson (1998) described how the population dispersed during late spring to autumn to inland regions and retreated to long term settlements (typically nearer the coast) in winter and early spring.

Various resources which were seasonably abundant would be preserved and the food taken back to these more permanent settlements (WT, 1991 - H1:76–77). Other purposeful travels included inland hikoi to collect pounamu and the annual migration south to the Titi Islands in autumn to obtain titi (mutton birds). Mahinga kai was the basis of the Ngai Tahu economy and culture before contact with Europeans.

European settlement inevitably impacted Ngai Tahu mahinga kai resources and patterns of activity. Evidence given by Ngai Tahu whanui to Commissioner Mackay in 1891, who convened one of the Royal Commissions, stressed the loss of mahinga kai and the consequent adverse impacts on the lifestyles of whanau and hapu. While

[3] "WT" is used as an abbreviation of the Waitangi Tribunal.

fishing and eeling were still available to whanau and hapu, eventually these sources of food were also at risk (WT 1991, F11:51).

In this chapter we distinguish kai gathering in four time periods:

- pre European settlement;
- post European settlement – in mid to late nineteenth century;
- twentieth century up until the 1970s and 1980s; and
- the present (results of the present study).

5.1.1 Pre-European settlement - Traditional settlements and patterns of resource use

Ngai Tahu place names provide insight into the use of lands and waters, and the resources sourced from them. Individual Ngai Tahu within their living memory would have a mental map of important places that supported their itinerant lifestyle, including camping places, settlements, and the different resources that could be obtained and utilised - all held in memory like whakapapa, where the sequence and significance of every place was known (Kruptnik, 2002). The writings of ethnographers, such as Beattie, yield hundreds of place names[4]. Sadly, over time the location of many has been lost.

Figure 4 illustrates some of many place names found across South Canterbury and confirms widespread use of the region by Ngai Tahu. Each of the sites in Figure 4 represents a valued mahinga kai site that was instrumental in providing the resources essential to sustaining whanau and hapu. A summary of the mahinga kai sourced from these sites are shown in Figure 5 with a more detailed list of the 38 species obtained from these sites across South Canterbury presented in Table 2.

[4] Beattie recorded over 1400 place names for Canterbury. Other ethnographers obtained more.

Table 2: Species were traditionally gathered from across South Canterbury.

SPECIES				
Eels	Smelt	Flounder	Potato	Turnip
Rats	Seals	Whitebait	Whale	Aruhe
Sea nuts	Kanakana	Patete	Kauru	Flax honey
Flax	Panako	Kumara	Shark	Groper
Shellfish	Paua	Sea urchins	Tutu	Kokopu
Koareare	Weka	Kahawai	Cabbage	Kokopara
Kanaka	Pakihi	Minnows	Taramea	Birds
Mullet	Puha	Watercress		

The 1880 map and accompanying manuscript, commonly referred to as the "Taiaroa papers" by Ngai Tahu, represent a highly valued "cultural map". It was an initiative by kaumatua from neighbouring hapu and facilitated by H.K. Taiaroa, to map their collective territory, their mahinga kai interests and values associated with particular sites[5]. These records allow a more complete examination of the system of food gathering system within the Canterbury and Otago regions.

[5] Nearly 1400 places across Canterbury and Otago were written down and mapped which coincided with the Smith Nairn Commission enquiry (1881).

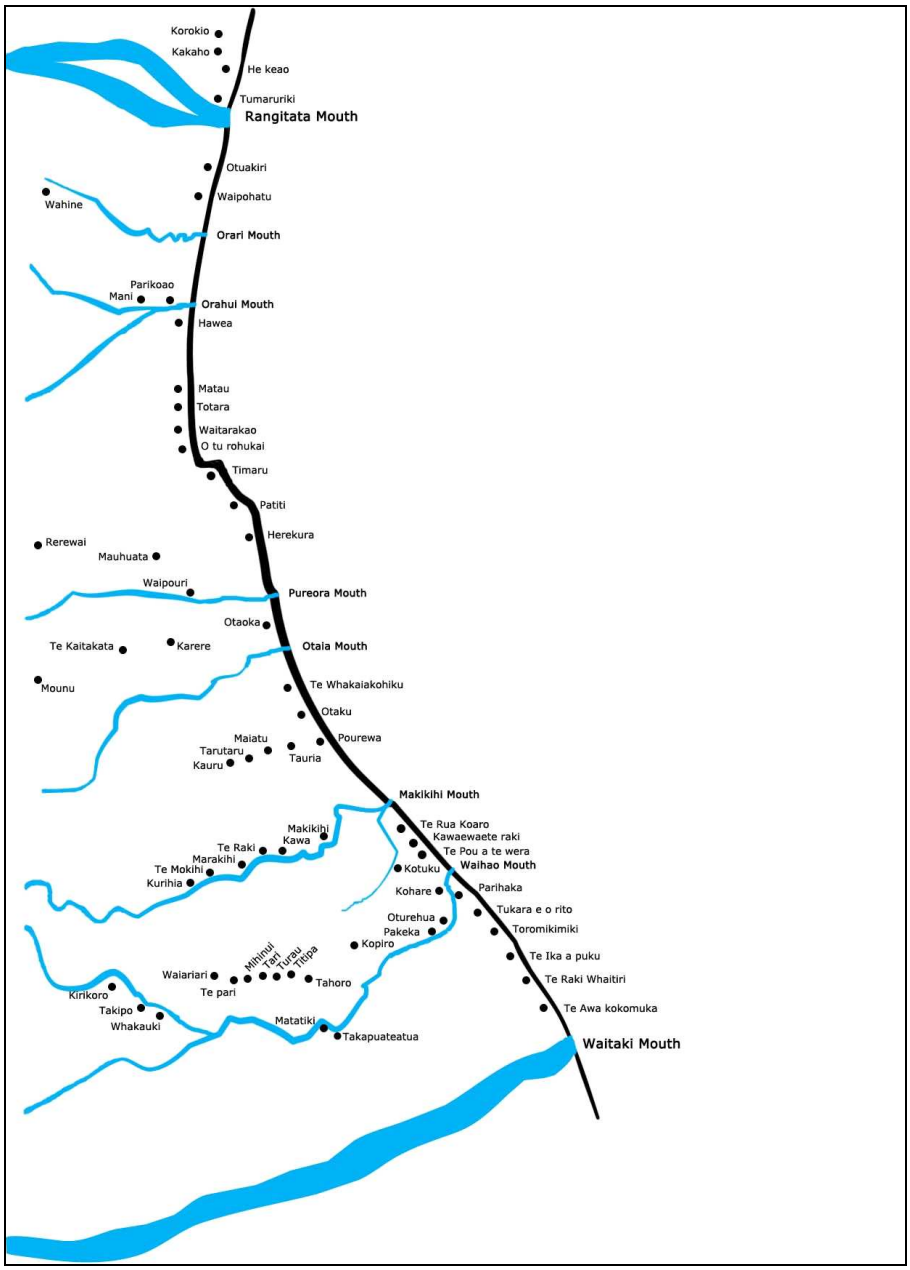


Figure 4: Traditional place names across South Canterbury.

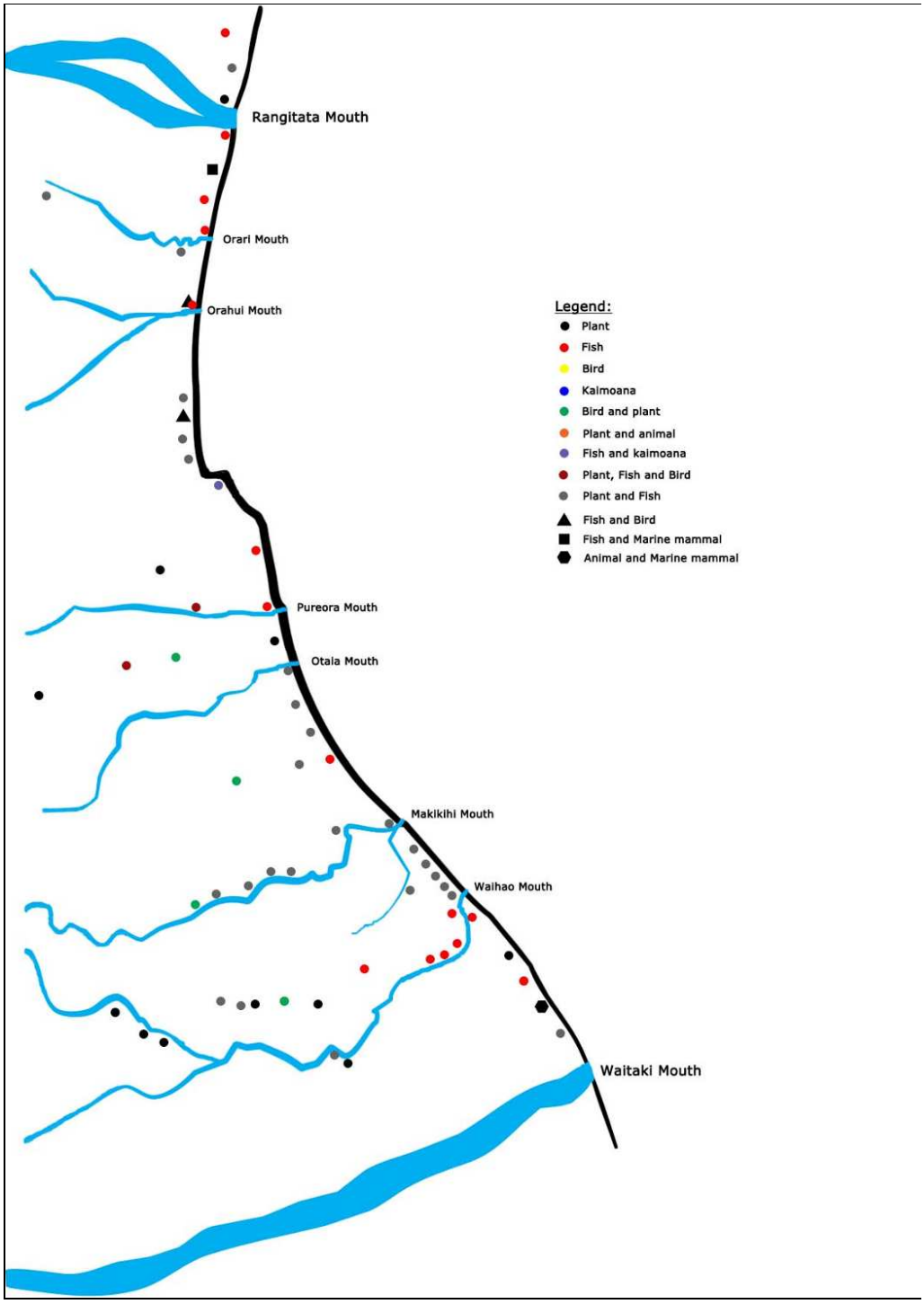


Figure 5: A few of the mahinga kai sites found across South Canterbury. (Please note that there were considerably more sites than those shown above. To avoid congestion of the map and to preserve the location of some sites, the names and uses of sites have been withheld).

As Table 2 shows, thirty eight different foods and materials were gathered from more than 100 sites across South Canterbury (between the Waitaki and the Rakaia and extending inland to the main divide). Table 3 shows the ten most commonly gathered species.

Table 3: Percentage of sites from which species were gathered from across South Canterbury.

SPECIES	PERCENTAGE OF
Eels	72%
Kauru (extract from the cabbage tree)	24%
Minnows	19%
Aruhe (bracken fern)	19%
Turnip / potato	13%
Whitebait	11%
Flax	11%
Koareare (root of the bulrush)	9%
Weka	8%
Kokopu / kokopara	8%

A distinctive social order emerged in the south shaped by the colder climate that dictated an itinerant lifestyle. Each whanau and hapu had rights to particular river reaches for fishing and defined lands for gathering wildlife and plants (Williams 2004, Anderson 1998). These areas were known as *rauiri* (preserves) and defined by *wakawaka* (boundaries) (Beattie 1939, Best 1942). It must be acknowledged however that traditionally rights had to be maintained through continual usage. Through an annual cycle of fishing, gathering and hunting, whanau and hapu "kept the fires burning" in many locations across a large tract of the South Island. Intermarriage between hapu and subsequent rights of inheritance and succession mean that for many Ngai Tahu today they now hold rights to lands across much of the southern region.

Historically enough kai was gathered to feed the immediate and extended whanau with some remaining to donate or trade. Mahinga kai meant survival. Sharing with those unable to gather for themselves is a practical expression of *whanaungatanga*. Concepts of *tapu* and *noa* shaped a management system that limited the scale of gathering (Anderson 1998, Williams 2004), but mistakes would have undoubtedly led to waste, overexploitation, and the collapse of some food sources. Knowledge of such mistakes passed from generation to generation in the form of *tikanga* and *kawa* (correct protocols and practices) the function of which was to prevent a repeat (Williams 2004).

Mahinga kai was the basis of an economy based "principally on the giving of gifts upon which were attached the obligations of reciprocity" (Williams 2004,p 88). By the time of European settlement Ngai Tahu had built a robust economy and a rich culture adapted to the local climate, resource base, and landscape (Evison 1993). Gathering was a social activity as well as an economic one. The extensive network of rivers, lakes, mountain ridges and valleys provided avenues of travel essential to Ngai Tahu social and economic relations. South Canterbury, in the middle of Te Wai Pounamu, provided links to the inland areas of the Mackenzie Valley, to the Upper Clutha and to Te Tai Poutini. Hapu and inter-hapu ties and alliances, the backbone of Ngai Tahu social and economic exchange systems, depended upon the free and easy movement of people within and beyond South Canterbury.

5.1.2 Post-European Settlement: Reserves and fishing easements awarded in 1848 and 1868

> *"Even after the land purchases, Ngai Tahu continued to gather their traditional food, not only from areas near their settlements but also in journeys to far places. Despite the development of pastoral farming by the new settlers many Ngai Tahu continued to rely on their traditional hunting grounds for their existence".* (Waitangi Tribunal 1991)

With promises of government payments for the purchase of lands, the retention of fishing and hunting rights, and allocation of a series of reserves, Ngai Tahu were persuaded to surrender title to significant tracts of land and the pattern of rauiri and wakawaka was disrupted. According to the Government's policy of setting aside reserves, small tracts of land were identified as reserves to protect Ngai Tahu from settlers. In practical terms however reserves enabled all lands beyond the boundaries of reserves to be opened for settlement.

Many of the reserves and fishing easements (listed in Tables 4 and 5 that were granted to enable the continuation of a food gathering lifestyle) can be traced back to Crown Grants to Ngai Tahu whanui which stem from the Southern Purchase Deeds negotiated between 1844 and 1857. As an unanticipated consequence of the sale and transition to newly acquired reserves, Ngai Tahu were no longer free to migrate seasonally across the plains of Canterbury.

As the lands along lowland catchments of South Canterbury were taken over by settlers, fences curtailed gathering of kai from many valued sites. Although Ngai Tahu were determined to maintain their relationship with mahinga kai, this period of land alienation and substitution with reserves and easements marked the initial transition from a traditional diet and a lifestyle dictated by resource utilisation.

Table 4: A list of some of the native reserves in the province of Canterbury (Mackay, undated).

Reserve Name	Acres	Interest
Section 12,373 Waikawa	150	
Kaikanui	4	Reserved in 1848 by Mantell in terms of Kemps Purchase
Arowhenua	376	Reserved in 1848 by Mantell in terms of Kemps Purchase
Waipopo	187	Reserved in 1848 by Mantell in terms of Kemps Purchase
Te Upoko o Rakaitaweka	20	Reserved in 1848 by Mantell in terms of Kemps Purchase
Tauhinu	23	Reserved in 1848 by Mantell in terms of Kemps Purchase
Waimatemate	40	Reserved by the Canterbury Association
Waikawa	138	Selected in lieu of reserve at Hakataramea
Rakipaua	20	Reserved in 1848 by Mantell in terms of Kemps Purchase
Arowhenua	2	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Arowhenua	150	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Arowhenua	30	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Arowhenua	20	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Waimatemate	500	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Waimatemate	30	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Waimatemate	10	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Waimatemate	20	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Taumutu	63	Reserved by the Governor General to supplement land at Taumutu
Kapunatiki	600	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Orari River (north)	10	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Orari River (south)	20	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848
Waitangi	10	Award of the NLC, 1868, in fulfilment of Kemps Deed of June 1848

Because this research focuses on aquatic ecosystems, Table 5 extracts from Table 4 the reserves relating to the Fenton Orders of 1868 and highlights their relationship to

aquatic ecosystems. These reserves and easements are important as even today they continue to sustain the gathering of freshwater aquatic species. However access to and the ability to gather many of the terrestrial species listed in Table 1 was denied from the mid nineteenth century.

Table 5: A Summary of Fenton Orders of 1868 resulting from Kemps Deed of 1848[6].

Location	Association with water
450 acres Waitangi District (Waihao Maori Reserve)	
30 acres District (Glenavy sections)	
10 acres Waitangi District – near Wainono (Te Houiri Maori reserve)	Fishing easement - Near Wainono Lagoon. Bounded on the westward by a small lagoon.
20 acres Waitangi District (Puhakati Maori Reserve)	Fishing easement
10 acres Waitangi District Awakokomuka Maori Reserve	Fishing easement (now inaccessible)
600 acres Timaru District – Kapunatiki	The southern boundary skirting the edge of the swamp
10 acres Timaru District – south bank Orari River	Fishing easement - Having 10 chains frontage to the south bank of the river
20 acres Timaru District – north bank Orari River	Fishing easement - Having 10 chains frontage to the north bank of the river (has now disappeared)
2 acres	Fishing easement - A square block of land from the stream from Waitarakao Lagoon (near Washdyke)
150 acres Timaru District – Kapunatiki Creek	Is now gone – disappeared.
72 acres	Part of island near Harereatou Lagoon in the mouth of the Umukaha River – this is now washed away.
20 acres Timaru District – Orakipaoa (to include old pa)	

Figure 6 illustrates the location of the fishing easements in Canterbury, including the five in the Arowhenua district which are highlighted.

[6] This information was sourced from Taylor (1950) and from descriptions found in a report titled *Research into Maori Fishing Reserves: Establishment of Rights – Objections and Complaints from 1840"*. The senior author was given a copy of the report by Kelly Davis.

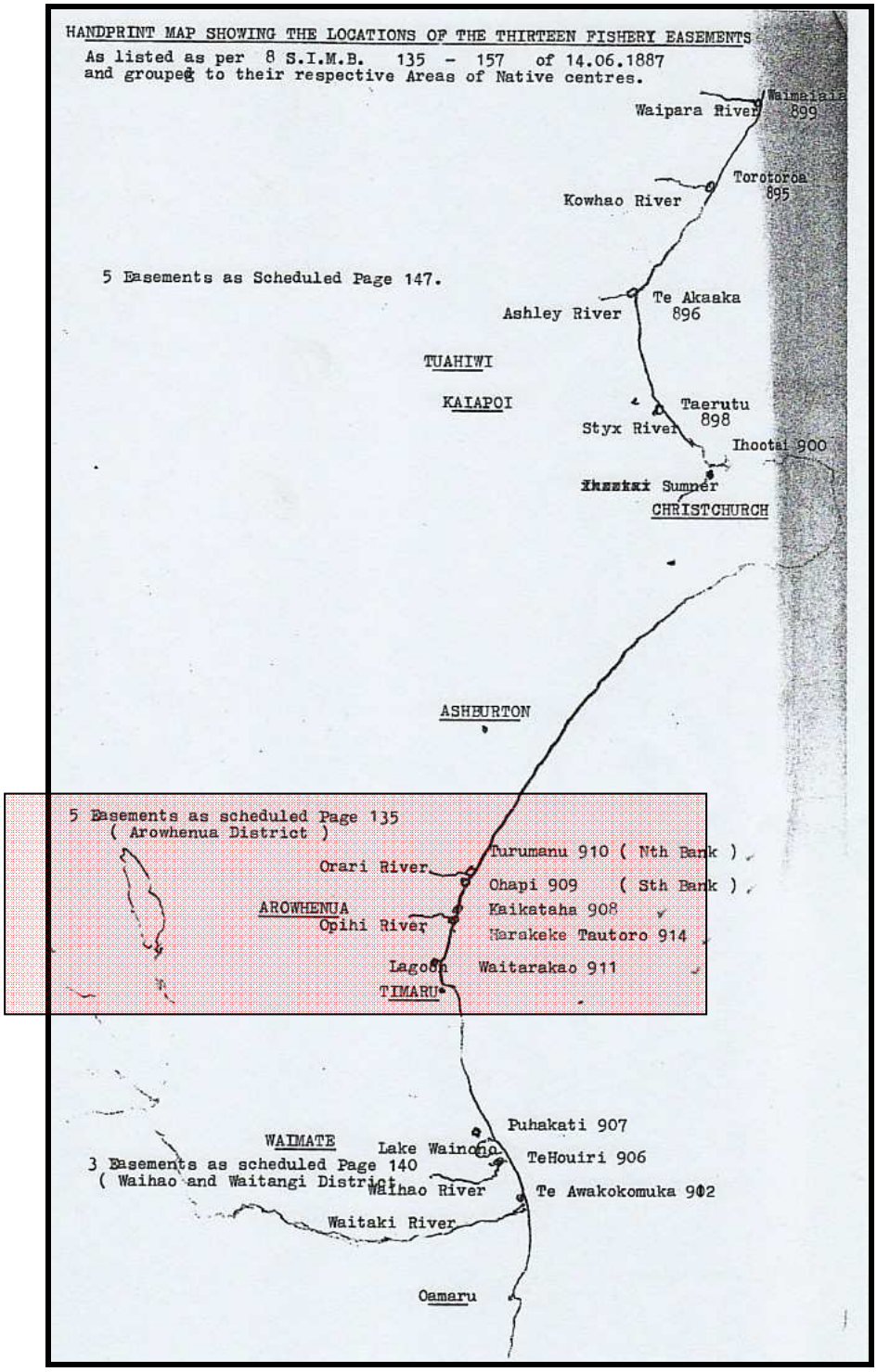


Figure 6: Location of fishing easements in Canterbury.

Figure 7: Coastline near Timaru – September 1874 (Australian National Library).

Figure 8: Washdyke Lagoon – near Timaru, October 1874. Thirty acres of this has now gone (Australian National Library).

Figure 9: Washdyke Lagoon 1874 (Australian National Library).

5.1.3 Comments presented in support of the Ngai Tahu Claim to the Waitangi Tribunal in 1989 – 1990.

Members of Te Runanga o Arowhenua presented evidence to the Waitangi Tribunal in 1989-90 in support of the Ngai Tahu Claim (Wai 27). They explained how all the lakes and rivers in the South Canterbury area that were once a source of food had been modified and adversely impacted since European settlement. These statements to the Tribunal provide insights into the changing mahinga kai practices experienced by whanau living across South Canterbury, and importantly with respect to this research, identify emerging contamination concerns.

Kai gathering

- Mr Jack Reihana recalled camping for a week or more to catch and preserve eels at Lake Wainono and spoke of an old lady bringing home large quantities of dried eels from Waitarokaoa (Washdyke) (WT 1991, H10:2).

- Mr William Torepe reviewed past and [then] present availability of mahinga kai from Waitaki to Rakaia (H10:4) which included kai such as tuna, fish, watercress, wild fowl and acclimatised species in the Opihi, Waihi and Temuka Rivers, Milford Lagoon, Hae Hae Te Moana, Kakahu, the beach in the vicinity of Pareora River, and Waimate Creek. He then proceeded to comment on the "diminution of Maori kai" and how this has affected their ability to manaaki guests on the marae (WT 1991, H10:8).

- Mr Kelvin Anglem spoke of the past abundance of eels in the Opihi which were preserved or bartered. He also commented on the [then] depletion of tuna, whitebait and kanakana (WT 1991, H10:19). He lamented the shortage of eels in the Opihi River which once supplied in one night their whole winter's supply.

- Mr Kelvyn Davis-Te Maire stressed that the areas were not merely important for mahinga kai but were also areas of historical importance (WT 1991, H10:33–34).

- Te Ao Hurae Waaka, related the past history of the district and how the whole area from the eastern seashore to the main divide had been accessed by Arowhenua (WT 1991, H10:47; H47.1).

The impacts associated with introducing exotic species

Although Ngai Tahu had repeatedly voiced their concerns at the impact of introduced aquatic species, the general consensus of those presenting scientific evidence to the Tribunal was that the decline in native species was due to changing land use rather than from competition with exotic fish. Mr Davis-Te Maire was critical of the management of water fowl by the Acclimatisation Society (now restructured as the Fish and Game Council) (WT 1991, H10:33). Mr Anglem described eel drives designed to protect young trout, when hundreds of eels were slashed and killed with lengths of hoop iron and allowed to flood down the river or left to rot on the banks (WT 1991, H10:23).

Water extraction

Mr Torepe spoke of the lack of water in the Opihi River - an important mahinga kai location (WT 1991, H10:2). He attributed this to the issuance of permits by the Regional Water Board to allow the Timaru City Council to draw off water for domestic supply and permits for farmers to take water for irrigation. He observed that this had the effect of reducing flows in the lower Opihi River, leaving it dry for at least three months of the summer with the consequent effect on kai resources. He claimed that the majority of streams and creeks within Canterbury had been transformed into flood channels. He believed the supply of fish in the Opihi River was now depleted as a result of water reduction.

The Opihi River has been affected by flow reductions since about 1936, when the Levels Plain Irrigation Scheme began operation. These reductions created a number of problems for fish stocks.

- Compounding the impact of low flows, another witness, Mr Sagar, contended that changes in land use within the catchment, and flood protection works had all contributed to modifying the river system.

- Mr Little stated that not only does water extraction lead to a loss of fisheries habitat, migration routes and cover, it also results in changes in temperature, increased weed growth and possibly destruction of the river (WT 1991, P15a:10).

It was thought that modest increases in the flow of the Opihi would improve the fisheries values of the river. A minimum was instituted following commissioning of the Opuha Irrigation Scheme. Although dewatering is not longer a problem, a number of issues persist.

The demands for water from so many uses, coupled with river re-alignment, plus land loss when floods washed away acres of reserve land, and the drainage of creeks and swamps, all served to adversely affect Ngai Tahu's access to mahinga kai. It also contributed to another serious consequence – the problem of pollution.

Pollution

Mr Anglem identified factors such as sewerage disposal, wool scour effluent, dairy factory discharge, aerial spraying and topdressing, farm waste and irrigation diversion which had reduced the Opihi and its estuary from an important breeding and feeding ground for migratory birds and fish into something unfit for humans and animals to swim in, concluding:

> *I am glad my Tupuna cannot stand on the banks of the Opihi and see what I have stood back and allowed to happen to their river.* (WT 1991, H10:24)

Mr Torepe (17.2.5) said that dirty and greasy effluent was discharged into the Waihi River at Winchester (WT 1991, H10:2). He also added that the beach in the vicinity of the Pareora River may be polluted by freezing works discharge of untreated remains (see Figure 10 below).

Figure 10: Opened in 1904, the Pareora Freezing Works is one of two meat-processing plants in the region – Smithfield at Washdyke is the other. The red hue in the sea is effluent from the works. (Photo source: www.teara.govt.nz/files/p11486gns.jpg).

A report from the water resources manager of the South Canterbury Regional Water Board (WT 1991, H49) dated 8 April 1988, describes the water quality in the Waihou River, Lake Wainono, Opihi River, Temuka River, Orari River, Rangitata River and the coastal zone. The problem of eutrophication within the Waihi–Temuka River system and the lower Orari River was highlighted. The report explained that eutrophication results mainly from the introduction of nitrogen and phosphorus. Fertiliser on farmland was seen as the major source of nitrogen. Domestic sewerage was believed to be the major source of phosphorous which it was thought could be addressed by upgrading the oxidation ponds at the Geraldine and Temuka treatment plants.

The witnesses to the Waitangi Tribunal concluded that there were serious water quality problems in the Temuka River and indeed they predicted problems in other rivers in the future. The members of the Waitangi Tribunal concluded after viewing the lower Opihi River that diverse sources of nutrients from adjacent farmland and the shortage of water in the river generally have changed the structure of the river with a serious effect on the mahinga kai qualities.

Without doubt, social and economic shifts during the last 160 years resulted in major changes in the relationship between Ngai Tahu and mahinga kai. The cumulative effect of settlement, an industrial economy that saw newly arrived settlers exploit all economic resources, plus the plethora of regulatory systems instituted by government, changed both the circumstances and practice of mahinga kai, with both natural environments and resources impacted, and consequently the knowledge generating processes associated with kai gathering being changed or alienated from many Ngai Tahu.

5.2 Contemporary patterns of gathering

This section draws on the data from the Kai Consumption Survey to describe contemporary kai gathering practices and behaviours. Where appropriate quotations extracted from the interviews with whanau members are added.

5.2.1 Background of participants

All participants were Maori residing in the South Canterbury region.

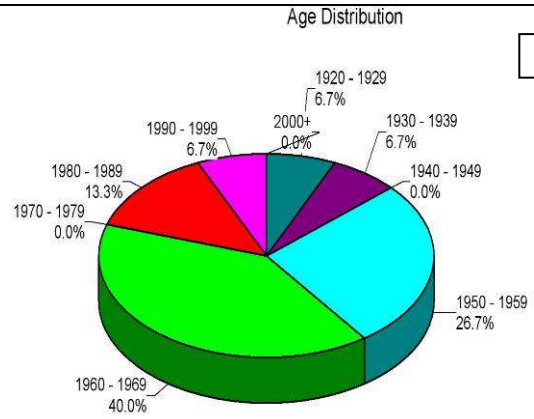


Figure 11

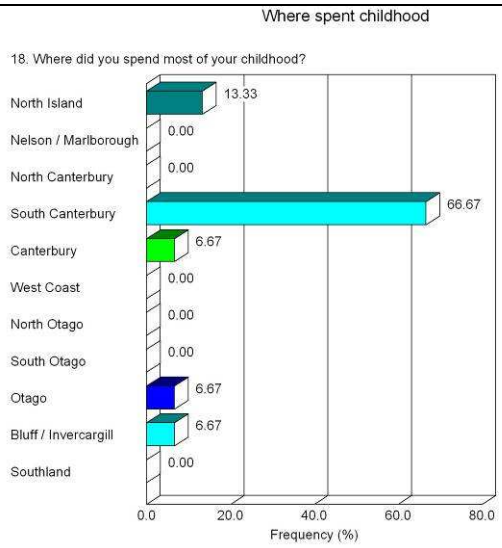


Figure 12

Only a limited number of participants have completed the survey (Figure 11):

- 1 is aged 10-19 years
- 2 are aged 20-29 years
- 6 are aged 40-49 years
- 4 are aged 50-59 years
- 1 was aged 70-79 years
- 1 was aged 80-89 years

Of the 15 participants 2 were female and 13 were male.

Two thirds of the participants spent their childhood in South Canterbury (within the takiwa of Te Runanga o Arowhenua) while two of the participants grew up in the North Island (Figure 12).

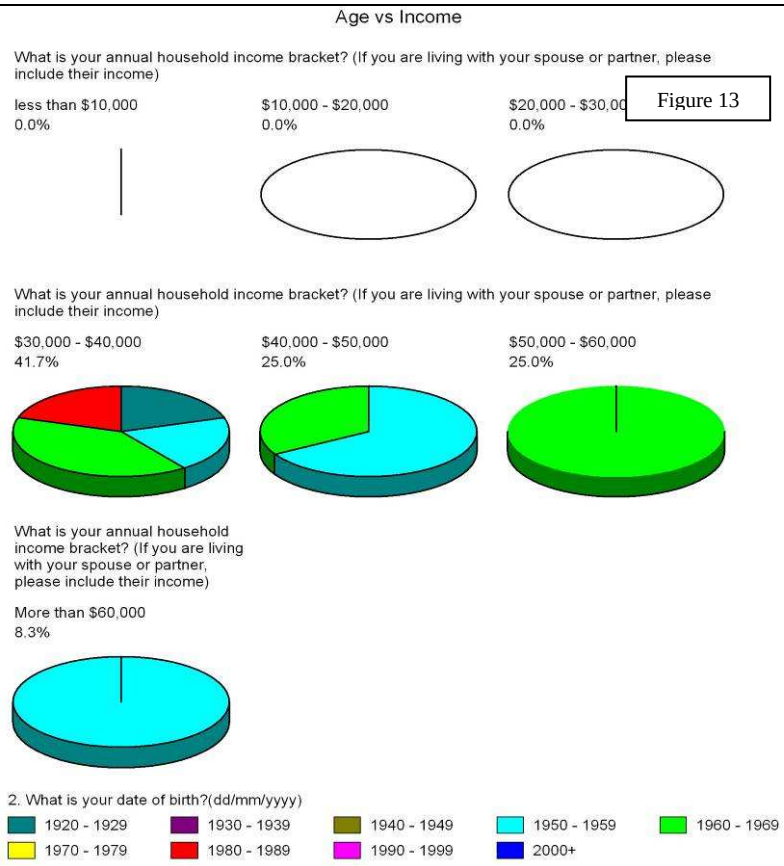


Figure 13

With respect to income (Figure 13)

- 41.7% received between $30,000-$40,000 – which was the lowest recorded.
- 25% earned between $40,000-$50,000.
- 25% earned between $50,000-$60,000.

The data relating to income, as shown in Figure 13, can be compared to data collected from the 2006 census when:

- 44 percent of Ngai Tahu reported an annual personal income of $20,000 or less, while 6 percent received over $70,000.
- The median annual income (half receive more, and half receive less, than this amount) for Ngai Tahu was $23,400 in 2006. In comparison, the median annual income was $21,900 for the total population of Maori descent, and $24,400 for the total New Zealand population.
- The median annual income was $30,200 for Ngai Tahu men and $19,200 for women.

5.2.2 Patterns of kai consumption

The principal purpose of the Kai Consumption Survey was to determine the extent of gathering by whanau living in South Canterbury. The range of species that are consumed are listed in Table 6.

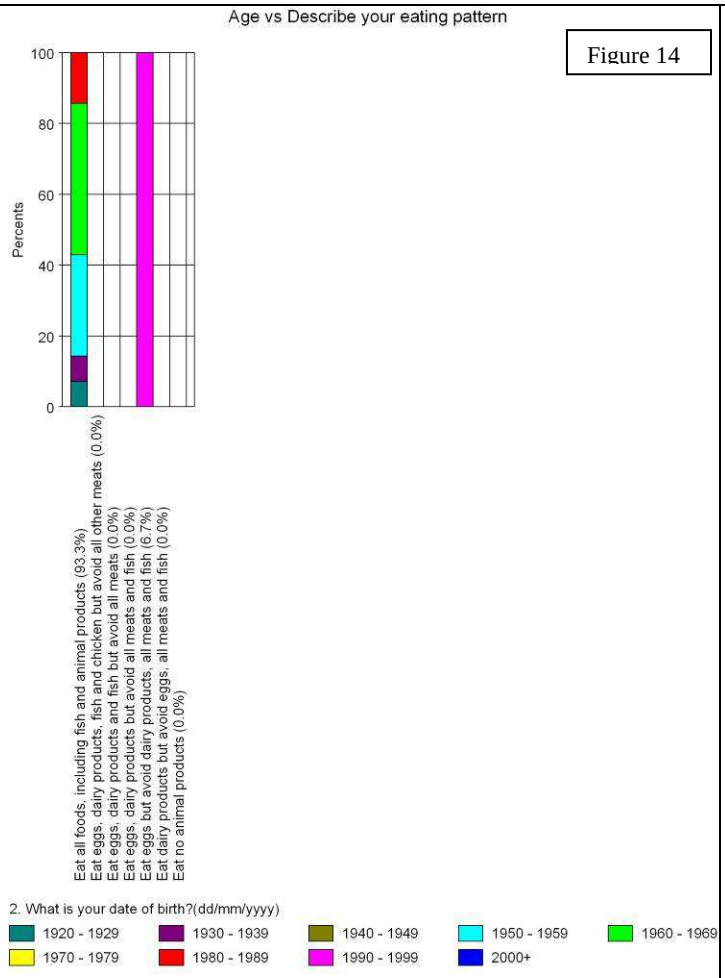
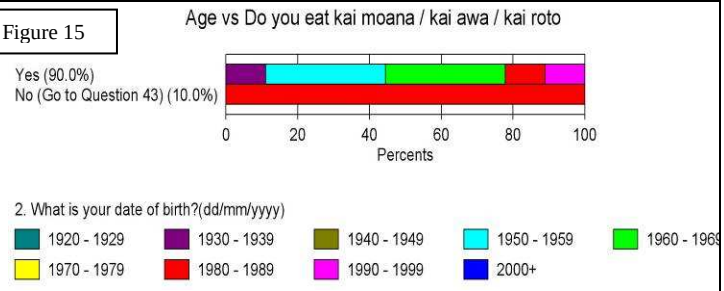


Figure 14

The majority of participants (93%) eat all foods, including fish, meat and all dairy products (Figure 14).

The exception was the tamariki who avoids dairy products, meats and fish.

Figure 15



90% of participants across all age groups eat kai moana, kai awa or kai roto (Figure 15). Only 10% (all aged between 20-29 years) do not eat kai moana, kai awa and kai roto.

Table 6: A comparison of foods historically sourced from sites in South Canterbury compared to foods gathered and consumed today.

KAI (**GATHERED** HISTORICALLY)	KAI (**GATHERED** TODAY)	KAI (**CONSUMED** TODAY)
		Butterfish
		Freshwater mussels
		Morihana
	Herrings	Herrings
		Pipi
		Cockles
		Toheroa
		Tuatua
		Greenbone
Kanakana	Lampreys	Lampreys
		Mutton birds
Eels	Eel	Eel
Flounder, Pakihi	Flounder	Flounder
Groper		Hapuka
Mullet	Mullet	Mullet
Kahawai	Kahawai	Kahawai
		Kingfish
		Gurnard
		Snapper
		Moki
Shark	Shark	Shark
		Tarakihi
		Trevally
Whitebait, Smelt, Minnows, Kokopara, Kokopu, Patete	Whitebait	Whitebait
	Trout	Trout
Sea urchins	Kina	Kina
Paua	Paua	Paua
	Mussels	Mussels
	Crayfish	Crayfish
	Oysters	Oysters
		Pupu
	Seaweed	Seaweed
		Freshwater crayfish
Watercress	Watercress	Watercress
Puha	Puha	Puha
Potato, turnip, cabbage		
Flax, flax honey		
Seals		
Aruhe		
Rats		
Koareare		
Sea nuts		
Whale		
Kauru		
Kumara		
Tutu		
Panako		
Weka		
Birds		
Taramea		
Shellfish		

Only 11 of the list of species gathered historically (as listed in Table 3) are still gathered and consumed today. These are highlighted in Table 6.

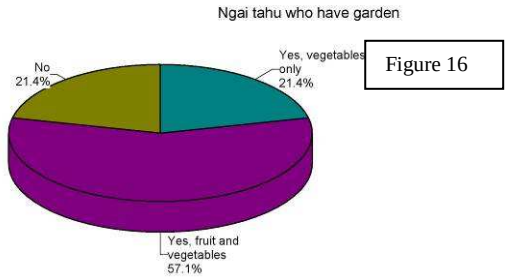


Figure 16

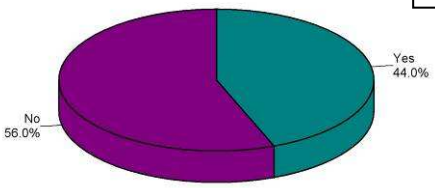
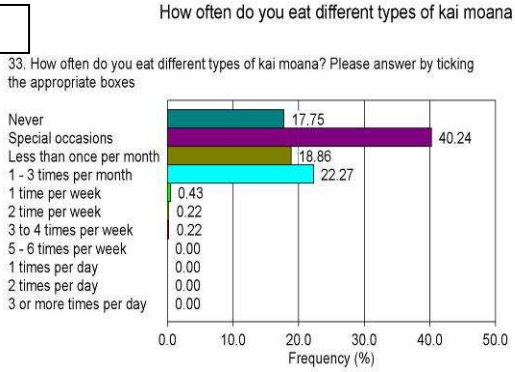


Figure 17

Figure 18



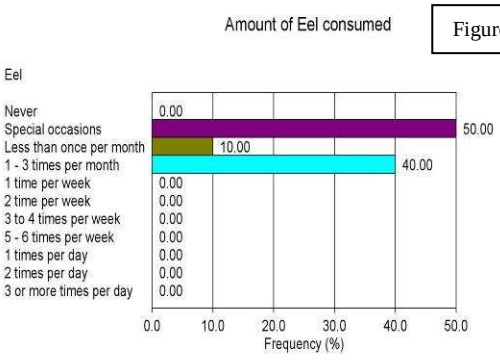


Figure 19

Consistent with the itinerant kai gathering lifestyle of their tupuna.

- 44% of respondents hunted, while
- 78.5% grew their own vegetables.
- Of the 78.5%, 57% of those who grew vegetables also grew fruit (Figures 16 and 17).
- The data also showed how after the introduction of potatoes and turnips by settlers, Ngai Tahu were quick to establish cultivations. However that was still combined with aspects of their itinerant lifestyle by resting lands and returning to use after being left for a period to recover.
- There is also a community garden and glass house at the marae.

Having determined that 90% of respondents do consume different types of kai:

- 40% of respondents said they now only eat kai on special occasions; while
- 18.9% eat kai less than once a month; and
- 22.3% only eat kai 1-3 times per month (Figure 18).

Figures 19 - 24 illustrate how often the various species are consumed:

- 40% of those eating eel have this food 1-3 times per month.
- It was of concern therefore that 70% of the respondents believed that there were now “a lot fewer” eels present.

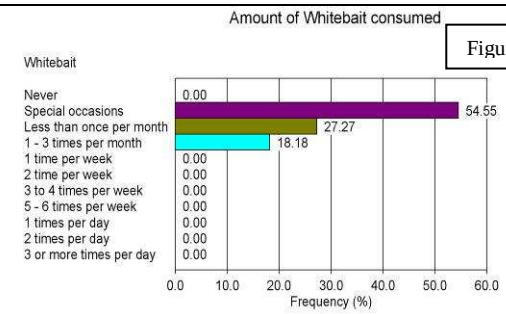


Figure 20

- For paua, whitebait, eel, flounder and crayfish at least 50% of the respondents indicate they consume these species at special occasions.

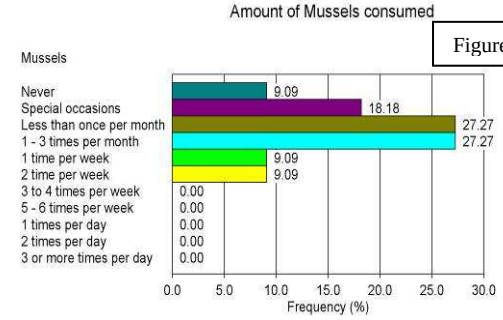


Figure 21

- Only mussels are consumed weekly – specifically once or twice per week. Interesting this is the only species that some respondents believed had increased in abundance.
- They also observed that mussels can now be easily accessed from supermarkets.

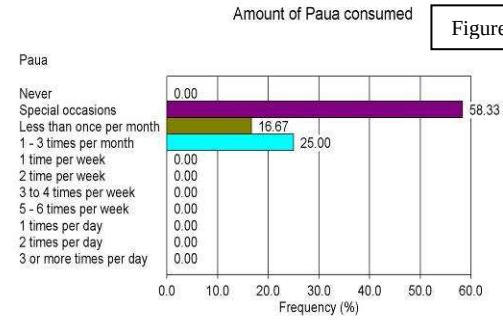


Figure 22

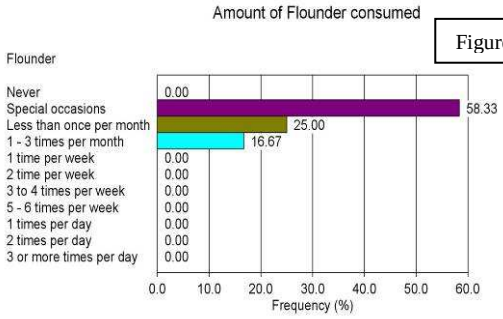


Figure 23

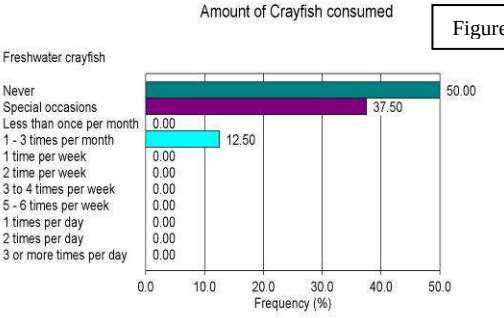


Figure 24

How respondents prepared their kai was also important. It was accepted that although many would prepare their own kai, others would purchase fish at take always, and supermarkets (as either fresh or tinned fish). Figures 25-27 illustrate the difference between age groups.

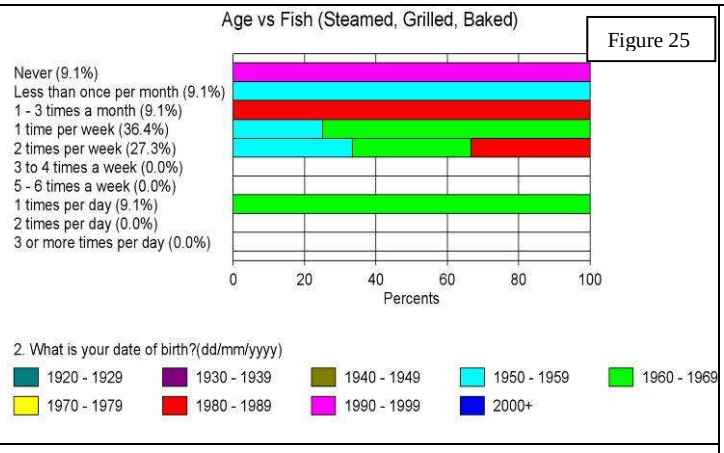


Figure 25

63.7% of respondents consumed steamed, grilled or baked fish at least 1 per week.

Today convenience foods can be purchased from a variety of sources and is available:

- As tinned fish;
- As fresh fish available in the deli of a supermarket; and
- As fish and chips at a take way store.

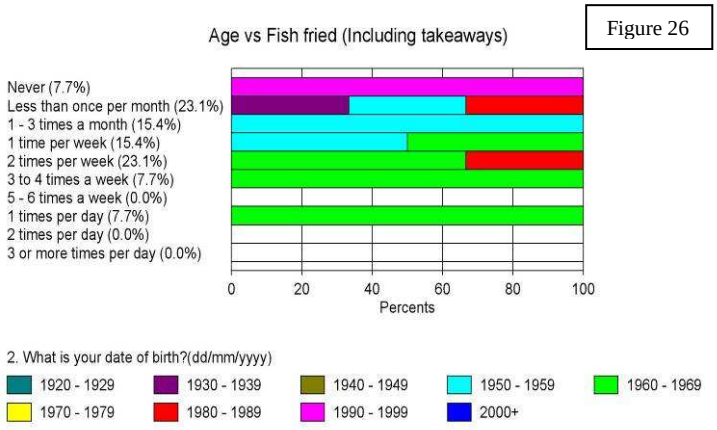


Figure 26

The graphs at left confirm that:

- Fried fish is consumed frequently and by one respondent at least once per day.
- 46.2% buy fried fish at least once a week.

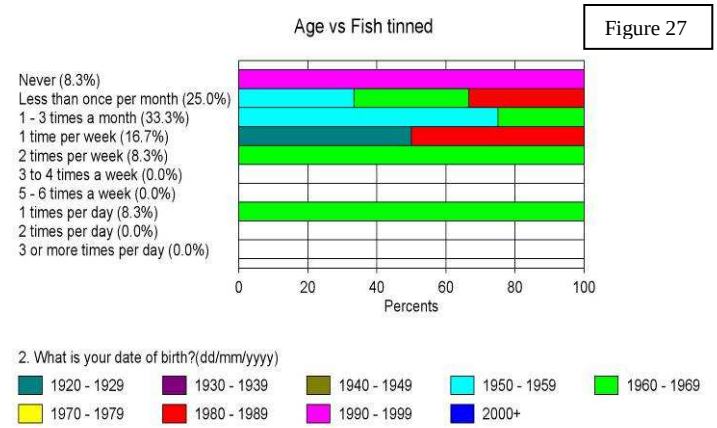


Figure 27

Interestingly Kaumatua consume fried fish less than once per month although in contrast they consume tin fish at least once a week.

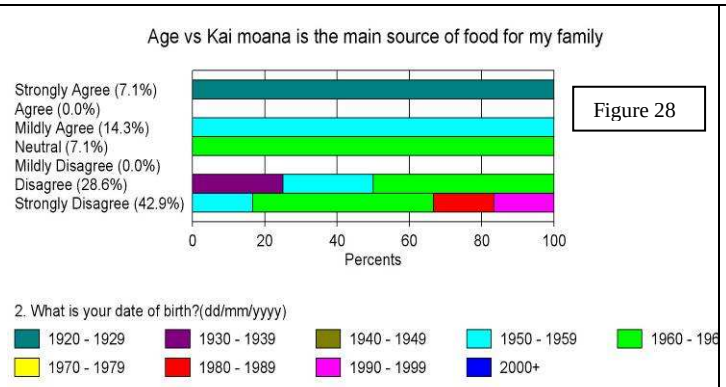


Figure 28

We wanted to determine how dependent whanau were on kaimoana. A question therefore asked if kai moana was the main source of food for the whanau.

- The oldest Kaumatua participating was the only one that strongly agreed with this statement.
- The others that agreed with this statement were aged 50-59 years. In contrast the rangatahi and tamariki participating all strongly disagreed with this statement. In fact 71% spread across four age groups disagreed or strongly disagreed – in other words kai was not the main source of food for their family.

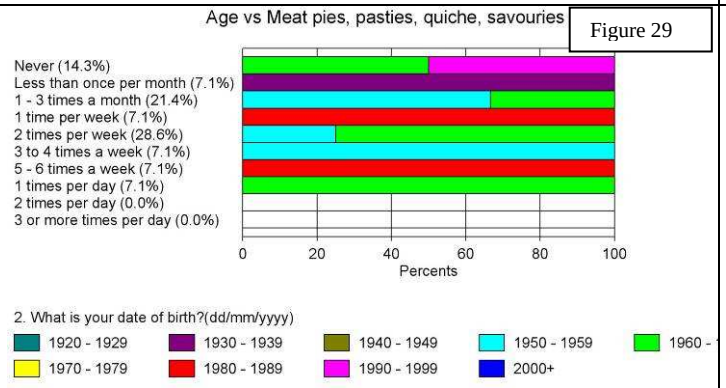


Figure 29

- Questions sought to identify changes from a traditional diet to a western style diet (Figure 29). It was of concern that 57% of respondents eat meat pies, pasties, quiche or savouries at least weekly, with 28% eating these foods twice a week and one participant eating these foods daily.

5.2.3 Estimates of the quantity of kai consumed

This research investigates the risk of contamination from eating wild sourced kai. A key consideration is the amount of kai that they are actually consuming. This is calculated by examining:

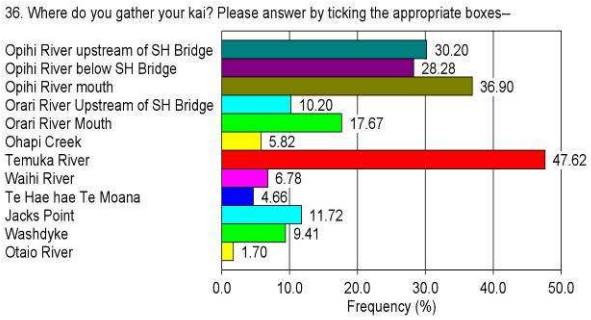
- the frequency or number of times they consume kai; and
- the quantity per sitting.

63.7% of respondents consumed steamed, grilled or baked fish at least 1 per week. From the data collected we also know that they consumed approximately 230.77 of fish per sitting. For mussels and whitebait the quantities change somewhat with participants consuming 157g and 302g per sitting.

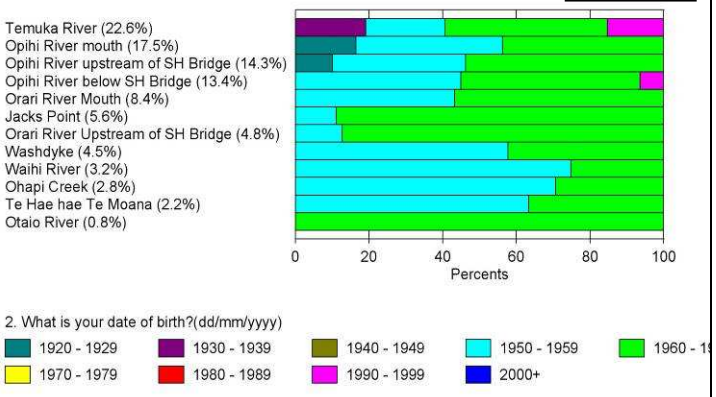
5.2.4 Sites at which kai gathering and other activities are undertaken

In addition to identifying the species gathered, the sites from which kai was sourced were identified. These sites were used as the basis for a sampling programme which examined contaminants in sediment and kai species (see Appendix 2 for site details). Figure 30 below confirms that 47.6% of participants gather from the Temuka River, while the Opihi River (upstream of State Highway 1, downstream of the State Highway, and the river mouth) are used by 30%, 28% and 37% of participants, respectively.

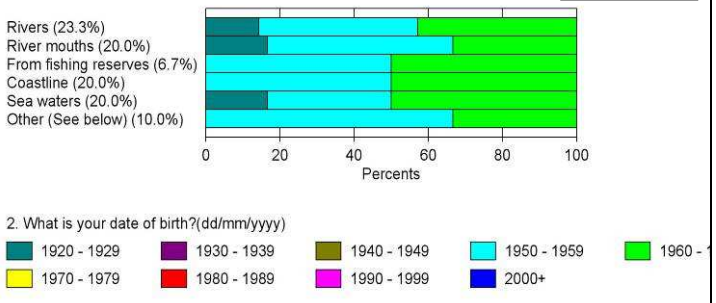
Where do you gather your kai — Figure 30



Age vs Where do you gather kai — Figure 31



Age vs Locations you gathered kai from — Figure 32



Of the sites listed in the Figures at left (Figure 30):

- There is easy access to the Opihi River and reserves at the river mouth.
- There are fishing easements on the south bank of the Orari River mouth and at Ohapi Creek.
- There is a reserve at Washdyke.

From the data collected it is also possible to identify the gathering preferences of the respective age groups (Figure 31):

- Kaumatua and tamariki fish locally from the Opihi and Temuka Rivers.
- Pakeke are the most mobile with those aged between 40-59 accessing most sites.

When identifying the reaches of a river that are fished by the respective age groups (Figure 32):

- Pakeke are the most mobile accessing most river types.
- Kaumatua limited their gathering to river mouths and coastal fishing.
- Only 6% fished from the reserves.

Figures 33 and 34 the various species that are sourced from the different waterbodies and the relative proportions of each species gathered.

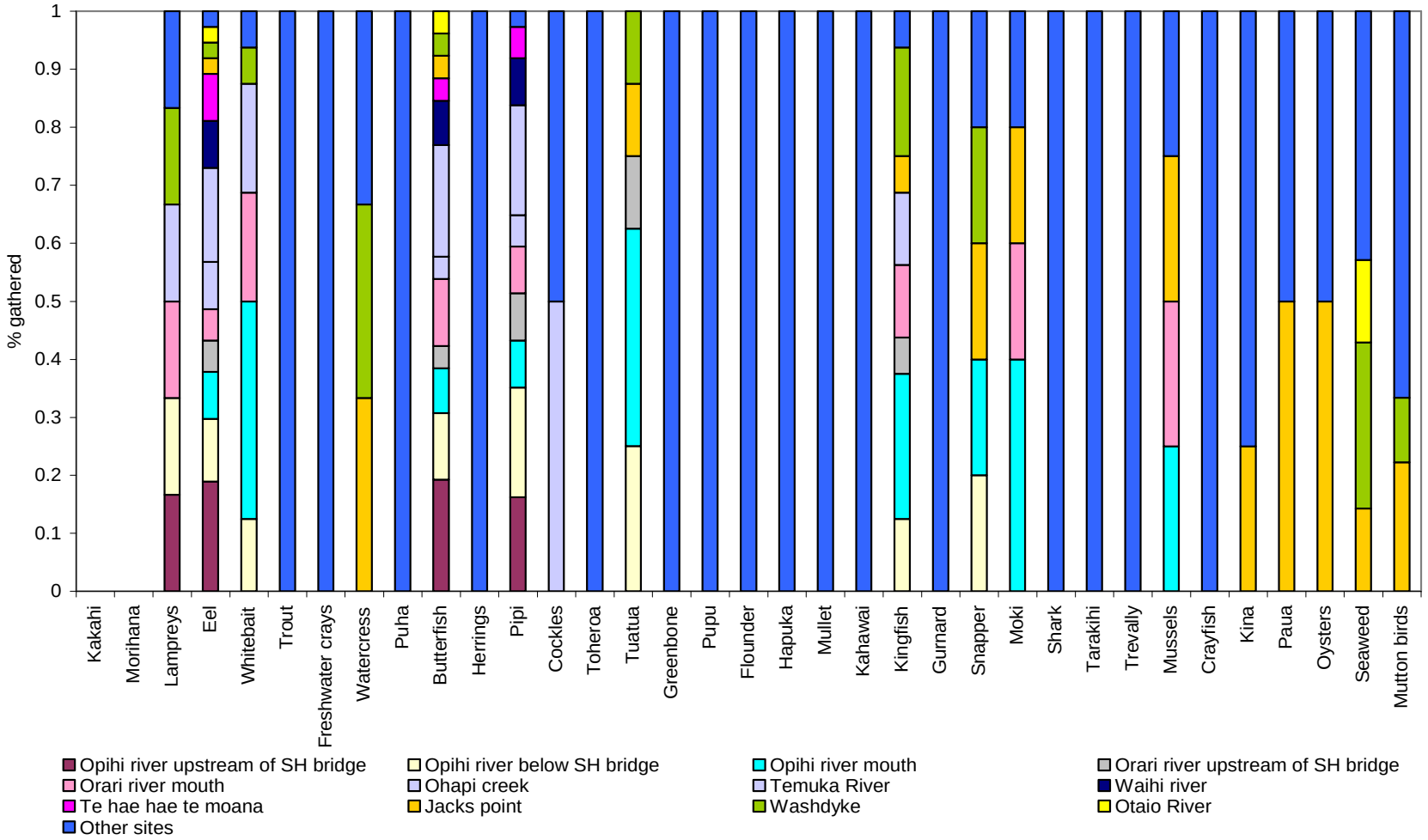


Figure 33: Relative proportions of sites from which the different species of kai were gathered.

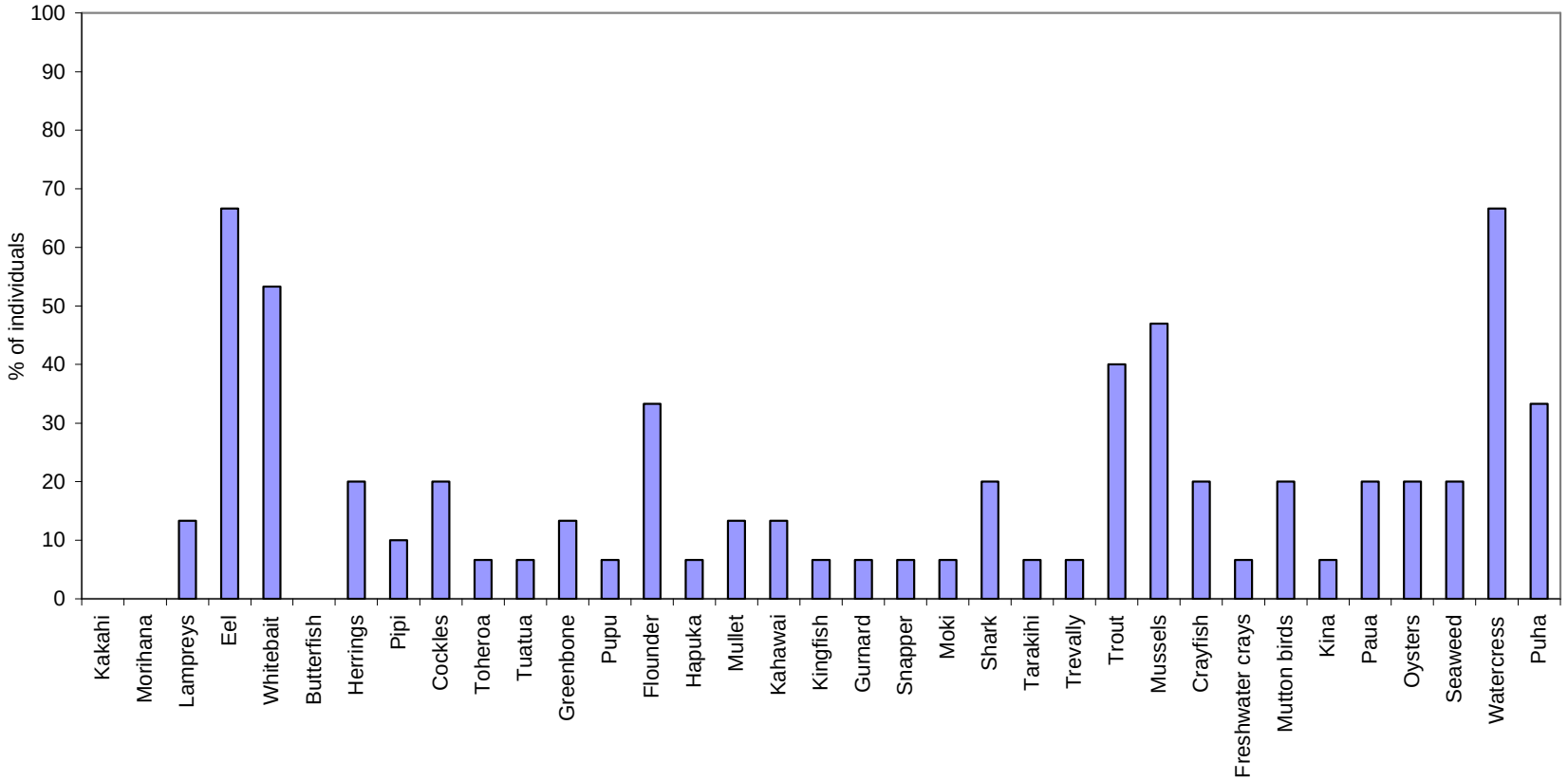


Figure 34: Percentage of individuals that gather different kai species.

In addition to gathering data about kai, data were collected about other activities undertaken at the respective sites, as contact with these waters could be a source of exposure to contaminants, rather than kai consumption. Figures 35-44 illustrate these additional activities. In summary:

- Swimming at some sites reflects their perceived high water quality.

- The two sites on the Opihi, in proximity to the State Highway Bridge, are popular for swimming with all respondents who use these sites.

- These two sites on the Opihi plus the Temuka also supported the greatest range of activities by whanau.

- The Temuka River and the Te Hae Hae Moana River are also swimming spots – again all respondents using these sites say they swim there.

- Sites that are known to be adversely impacted by activities in the catchment (and thus suffering degraded water quality) received mixed levels of use:

    - Jacks Point supports a range of fishing related activities but limited swimming (only 25%).

    - Ohapi Creek, one of the fishing easements, is used solely for fishing.

    - Washdyke, one of the reserves, is used solely for fishing.

    - Opihi River Mouth supports a range of activities but only 40% of the respondents swim there.

    - Otaio does not support swimming.

Photos are included beside each figure to give a visual depiction of the site.

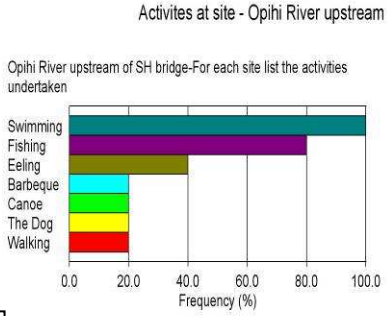
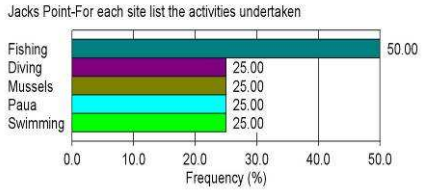


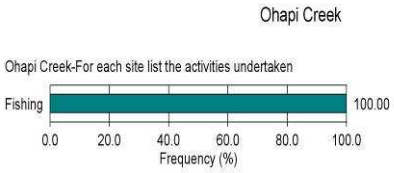
Figure 35

* Note: Multiple answer percentage-count totals not meaningful.



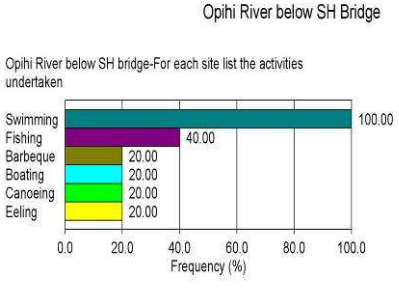
* Note: Multiple answer percentage-count totals not meaningful.

Figure 36



* Note: Multiple answer percentage-count totals not meaningful.

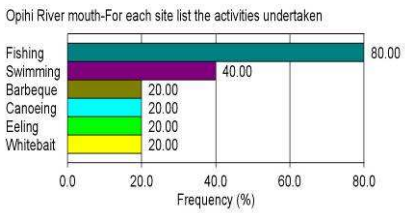
Figure 37



* Note: Multiple answer percentage-count totals not meaningful.

Figure 38

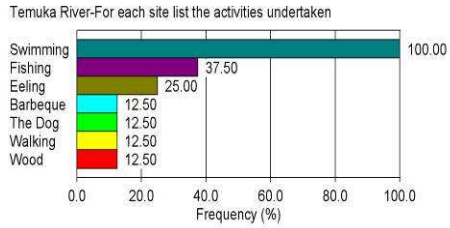
Opihi River mouth



* Note: Multiple answer percentage-count totals not meaningful.

Figure 39

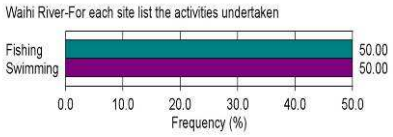
Temuka River



* Note: Multiple answer percentage-count totals not meaningful.

Figure 40

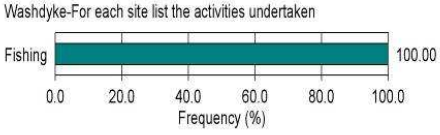
Waihi River



* Note: Multiple answer percentage-count totals not meaningful.

Figure 41

Washdyke



* Note: Multiple answer percentage-count totals not meaningful.

Figure 42

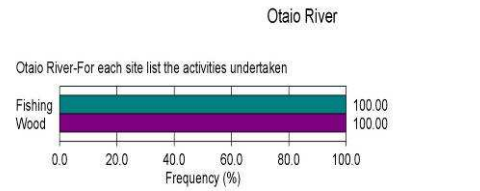


Figure 43

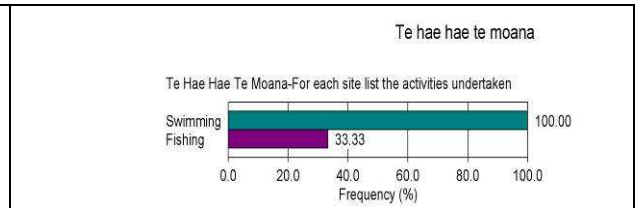


Figure 44

5.2.5 Other sources of kai

This project aims to assist the risk of exposure to contaminants associated with kai gathering. If there are concerns about the safety of kai consumed, and people are consuming kai that has been gifted, it is important to know where the kai comes from.

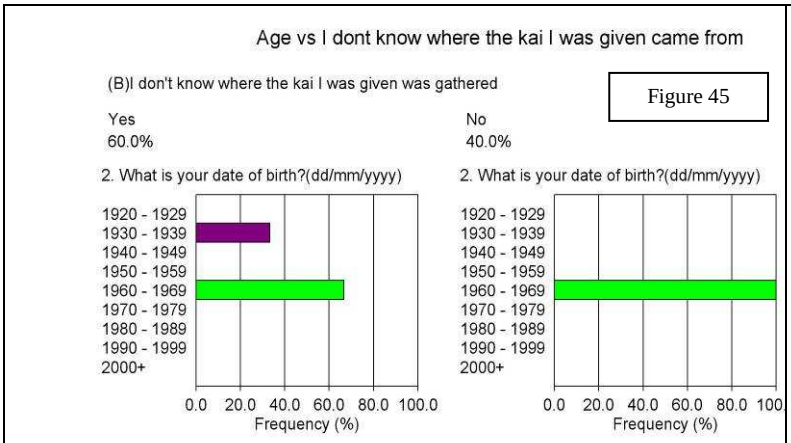


Figure 45

60% of respondents indicated that they did not know where the kai they were given was sourced.

Assuming the sites whanau gather from would change if the condition of the site was degraded; respondents were asked if they were able to gather from the sites that they have always gathered from.

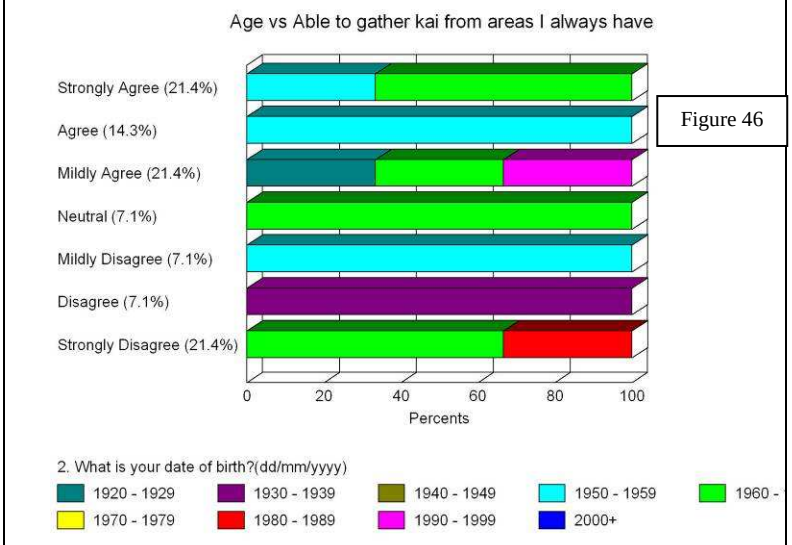


Figure 46

- 56% agree that they can.
- 35% say that they cannot.

No trends can be detected when looking at the respective age groups.

As whanau explained:

I still go there (Washdyke) on the sea side of it when it's (whitebait) in season and I still venture into the lagoon for kanakana.

We have gone as far Rangitata and Moeraki. With Moeraki always being used for paua and pupu which were gathered with Aunty and she would show us how to make kelp bag.

Paerora River was where they washed the bodies. I have just found out When we were younger we would go to the Waihao for kanakana and eels and we never touched the Paerora but I never knew why till now.

My favourite eeling spot is between the Temuka Road Bridge and the Manse Bridge and beyond. In that stretch of water when we were young we could catch around 50 eels and it was no hassle. You would see as many go past you as you spear but today in that same stretch of water you would see 5 eels that were not able to take.

Mainly around here I go to the Opihi. But lately in the last few years I wouldn't go floundering there because of the smell as the lagoon would get built up and water get stagnant and really bad smell. To me it goes to the fish and you couldn't eat it.

To Jacks Point for mussels. A lot of people gather around the wharf but I wouldn't because of all the oil and stuff that comes from the boats. I would go to Jacks Point where it's a lot cleaner.

The prime area being the Temuka and Opihi River and Awarua River (joined the Temuka straight across from the Marae). Awarua River was where we get a lot of watercress and we still do and freshwater koura. And tuna those were the basic ones we took from there.

5.2.6 Preferred kai species

Tuna was a major part of our diet. Most people didn't have the money to go out and buy food so they would use the awa as much as possible. They would go through the seasons from eeling in the summer through to March. Then move to kanakana in June / July / August in the colder parts of the season and whitebait as well. Then tuna would start to come back into season September onwards.

There was always kai around. If you couldn't get it in one place you would go to other places. If we didn't get paua here we would go down to Moeraki and if we couldn't get tuna here we would go somewhere else. It all depends on the time of year. We get patiki at certain times of year at spring time. There was always an abundance of food at that time but there was also a matter of storing it and preparing it so you could keep.

A question asked respondents to choose from the list of kaimoana, kai roto, or kai awa species those that they most preferred to eat. They were only allowed to choose their "top 6". These were to be their preferred kai.

- "1" was to be written beside their most preferred food;
- "2" was to written alongside their second choice;
- down to "6" which is to indicate their 6th preference.

Surprisingly, the top 6 preferences according to the ratings (in order of preference were):

5. snapper, koura
6. kina
7. trout
8. pupu, pipi, cockles, herrings, oysters.

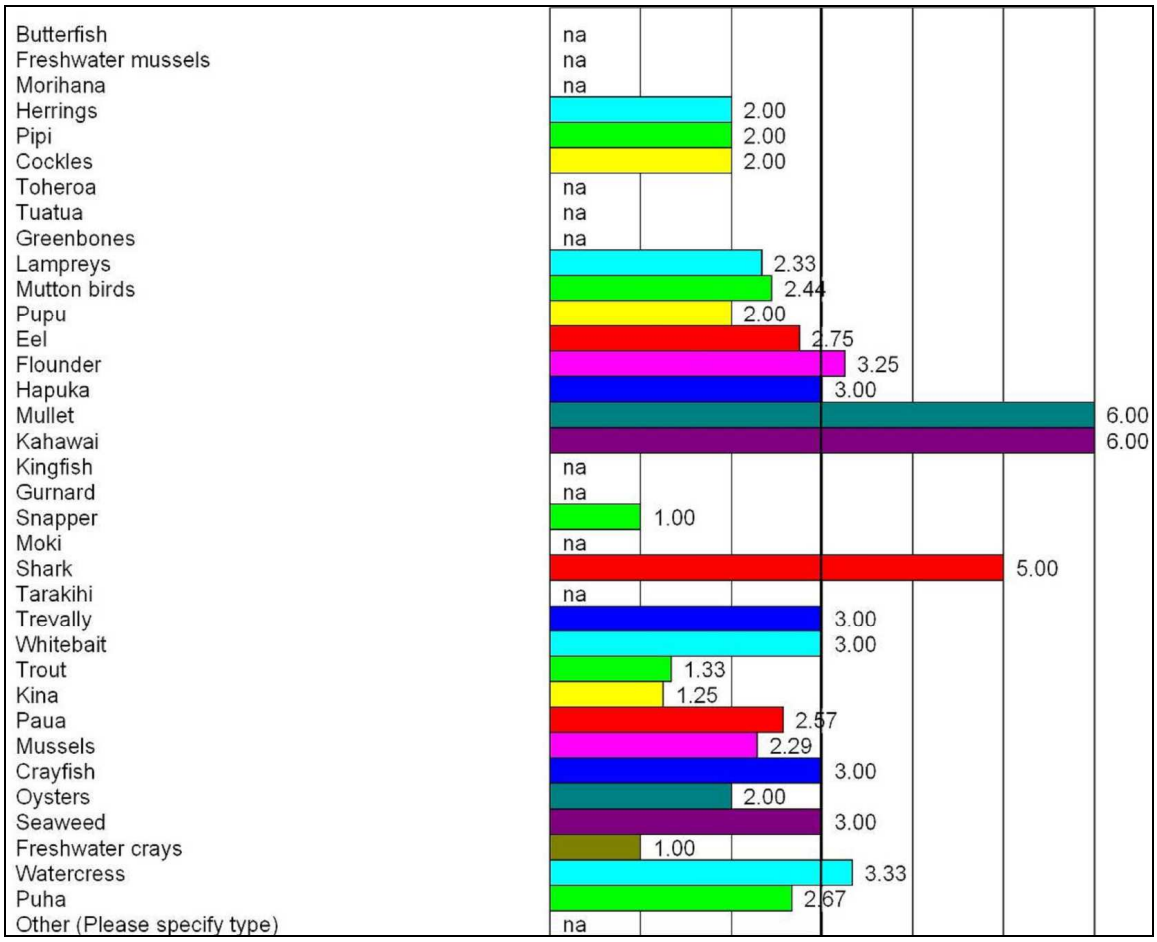
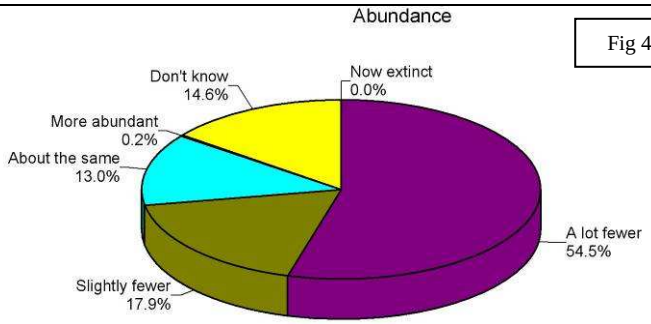


Figure 47: Preferred kai species (Numbers 0- 6 on the x axis represent the preference of whanau – 1 being the most preferred and 6 the lease preferred)

5.2.7 Perceived changes in the abundance of species that are gathered

If kai moana, kai awa and kai roto are to be promoted as a beneficial source of food for whanau, there need to be sufficient quantities of healthy stocks in order to sustain gathering. Questions in the Kai Consumption Survey asked whanau to provide their assessment of the stocks of various species gathered.



Of concern 54% of respondents believed that across all species gathered there were now a “lot fewer” available while another 17.9% believed that abundance was “slightly fewer”(Figure 47).

Table 8: Changes in the abundance of species (as a percentage)[7].

SPECIES	A LOT FEWER	SLIGHTLY FEWER	ABOUT THE SAME	MORE ABUNDANT
Butterfish	25	25	25	-
Kakahi	50	25	25	-
Morihana	33.3	33.3	-	-
Herrings	50	25	25	-
Cockles	37.5	37.5	-	-
Pipi	40	20	-	-
Toheroa	50	25	-	-
Tuatua	33	33	33	-
Greenbone	50	25	-	-
Lamprey	75	12.5	12.5	-
Mutton birds	50	12.5	25	-
Pupu	60	20	-	-
Eel	70	20	-	-
Flounder	57	14	14	-
Paua	71.4	14.3	14.3	-
Mussels	50	25	12.5	12.5
Crayfish	66.7	16.7	16.7	-
Oysters	60	20	20	-
Seaweed	66.7	-	33	-
Koura	50	25	25	-
Watercress	37.5	25	25	-
Puha	45.5	18.2	27.3	-
Hapuka	50	25	-	-
Mullet	50	25	-	-
Kahawai	50	25	25	-
Kingfish	33	33	-	-
Gurnard	33	33	-	-
Snapper	33	33	-	-
Moki	50	25	-	-
Shark	50	25	25	-
Tarakihi	66.7	-	-	-
Trevally	66.7	-	-	-
Whitebait	70	10	10	-
Trout	14.3	42.9	28.6	-
Kina	75	25	-	-

As whanau explained:

Eels have diminished in number and they are probably the last species to be affected. You were once able to get crayfish you can't get crayfish in the local area. Paua again have diminished in number and size…..We now go to Moeraki to get them or elsewhere. Same thing for mussels they are virtually gone.

[7] Perceptions with respect to individual species are summarised in Table 8 with graphs included as **Appendix 1**

There are flounders we are finding now because of the quality of water in the lagoon and unless the mouth is open constantly then the patiki is muddy are horrible to taste. We don't even bother going out when the mouth is closed. It's tainted.

Our very best catchers can't get our customary take, as you can't get it. It's down to commercial eelers. Even 10 to 15 years ago if there was a tangi you could walk from the Temuka Bridge to the Manse Bridge which is about 800m and you would get at least a full bag of eel. Now you would be lucky to get two. You may get a dozen if three or four people were out with torches.

Watercress as well, there is a lot less around and the sprays they use these days and the run off from the farms in polluting the rivers.

Whitebait has dropped off in quantity with sometimes having a reasonable season but 99% of time it has diminished and more whitebaiters. Tuna is slowly disappearing.

5.2.8 Kai gathering behaviours

It cannot be assumed that all kai consumed is gathered by the respondents. Questions in the survey therefore asked about purchasing kai and sought to understand if it was shared within the whanau and wider community.

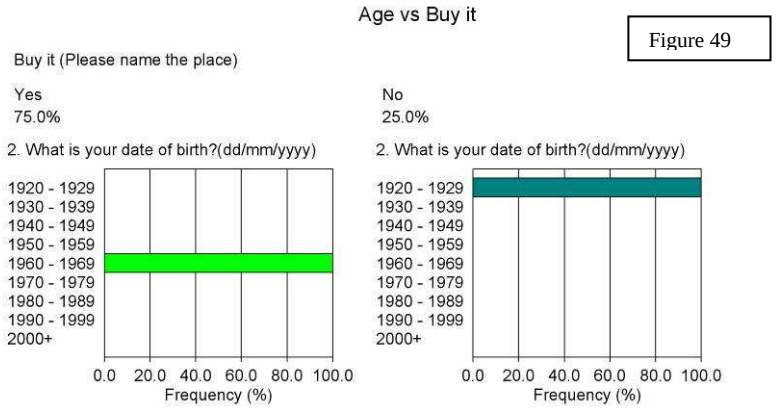


Figure 49

- 75% (all aged 40-49 years) buy some of their kai (Figure 49)
- The kaumatua did not purchase kai.

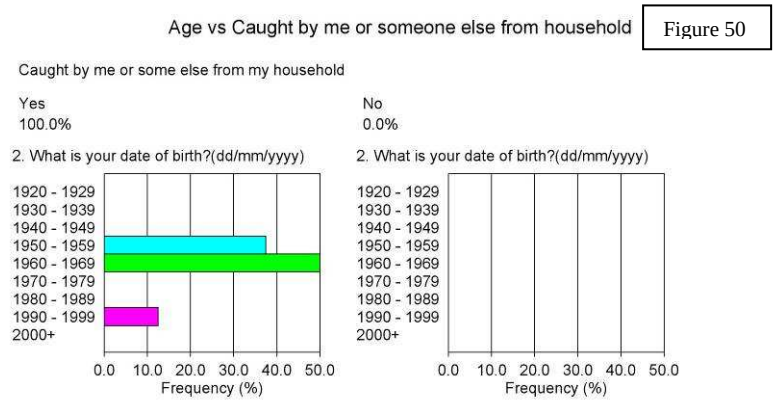


Figure 50

- Those aged 40-59 years and the tamariki confirmed that they caught their own kai (Figure 50).

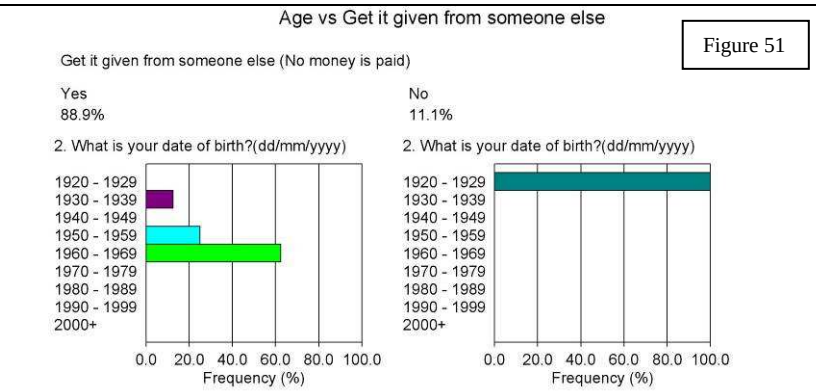


Figure 51

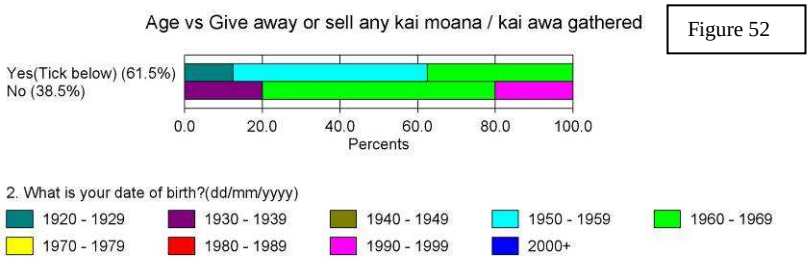


Figure 52

- 88.9% of participants said that they also were given kai (Figure 51).
- One kaumatua indicated that they were given kai from someone else as a koha while another kaumatua indicated that they were not given kai.

- 61% of participants gave away or sold some of the kai they gathered (Figure 52)

Aside from knowing how to gather kai, whanau need to know how to prepare the respective species.

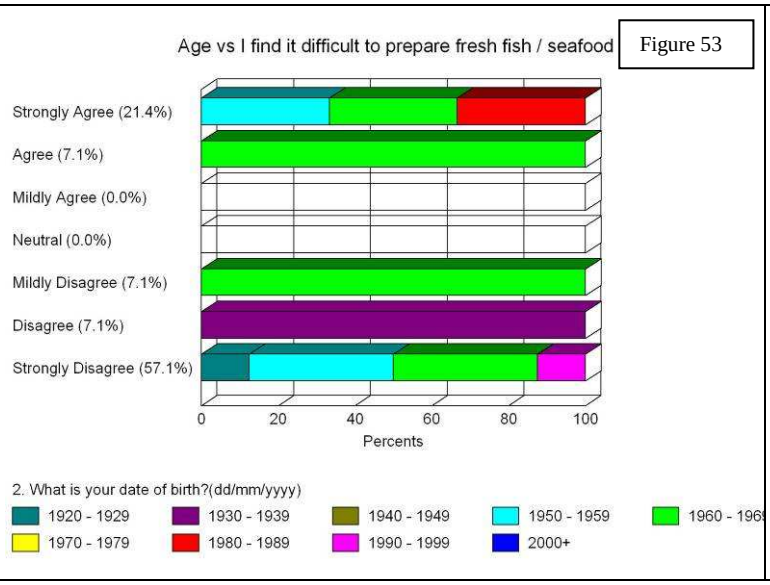


Figure 53

71% of respondents disagreed with the statement (57% strongly disagreeing) that it was difficult to prepare fresh fish and seafood. In other words 71% knew how to prepare their kai (Figure 53).

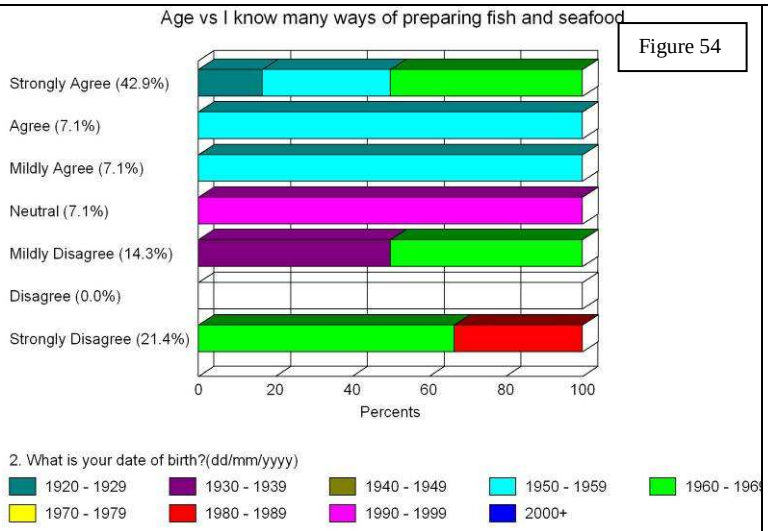


Figure 54

Of note however was the difference between generations.

Kaumatua disagreed with the statement. In contrast those: 57% of respondents (all aged 40 years and over) know many ways of preparing kai (Figure 54). In contrast and consistent with the earlier observation, those aged 20-29 years replied that they definitely did not know multiple ways of preparing kai.

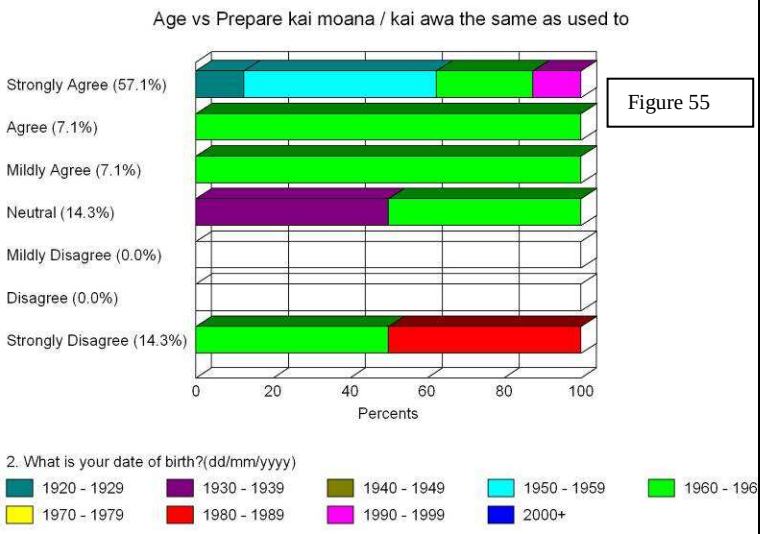


Figure 55

Interestingly Kaumatua (aged 70-79 years) also indicated they didn't really know many ways of preparing kai which could be interpreted as saying they prepare kai the same way that they have always done (Figure 55). In fact, 71% of respondents indicated they prepared their kai the same way as they have always done.

5.2.9 Perception of the environment

Maori experience environments and central to their continued interaction and utilisation of environments will be their perception of the good health of such areas. A number of questions in the survey asked for them to give an assessment of the condition of the sites from which they gather kai.

Figure 56

Responses were mixed when asked about the condition of sites (Figure 56), with:

- 35.7% believing sites to be in good condition while
- another 28.6% did not provide an assessment.
- only 28% appeared to believe that sites from which they gather are not in a good condition.

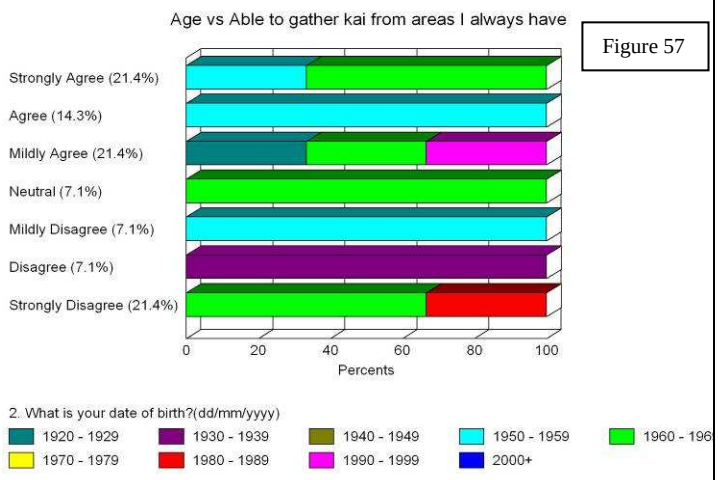


Figure 57

This is supported by the assessment of 57% of respondents (all aged 40 years and over) believing that kai could be gathered from the same sites that have always been accessed (Figure 57). An exception being a kaumatua (aged 70-79 years) who believed they could no longer gather from the sites they have previously been able to.

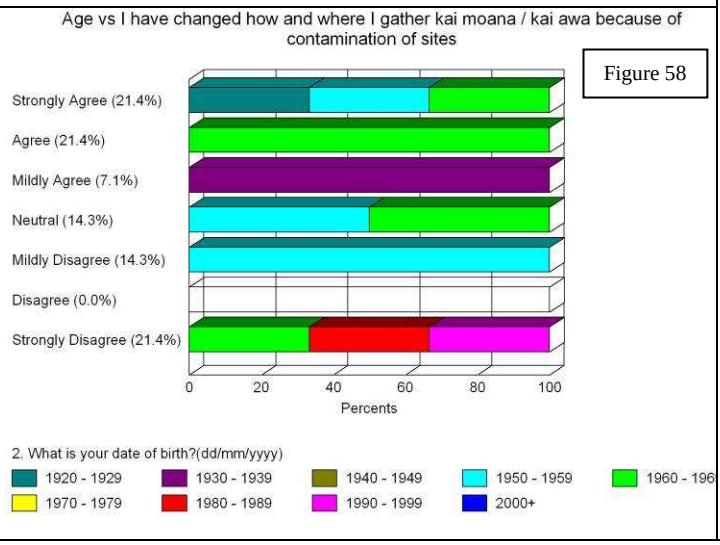


Figure 58

Responses were also mixed when asked about changing the sites they gather due to perceived contamination at the sites (Figure 58):

- Kaumatua agreed that they had changed gathering behaviours.
- 50% had changed their gathering behaviour (all of them aged 40 years or over).
- Those who strongly disagreed were all aged less than 40 years.

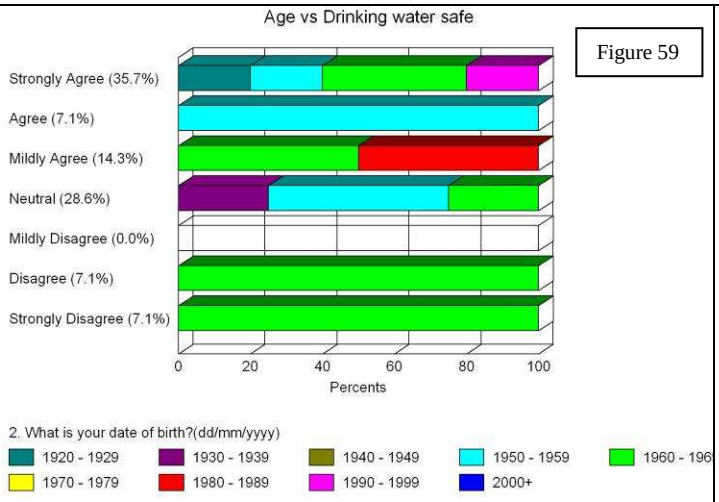


Figure 59

The majority of participants (56.8%) believed that their drinking water was safe (Figure 59). But 28.6% did not comment.

No clear trends emerged when asked if kai gathering was dangerous to the health of respondents because of pollutants or toxins.

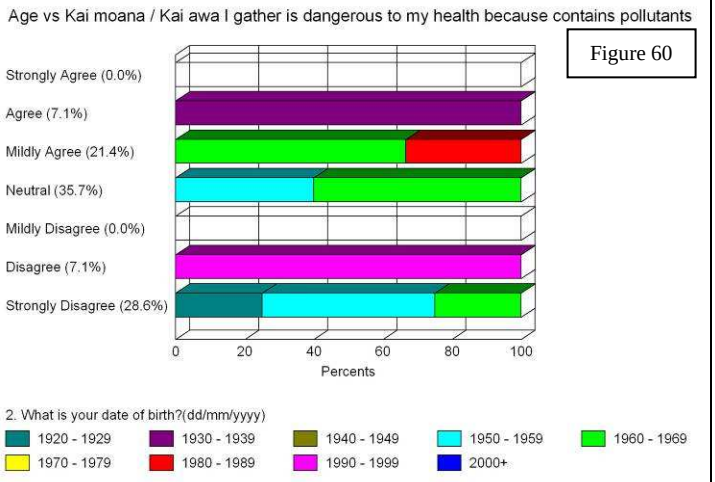


Figure 60

In relation to pollutants:

- 28.6% strongly disagreed with the statement that the kai gathered was dangerous to human health because of pollutants (Figure 60).
- However 35.7% did not provide an assessment.

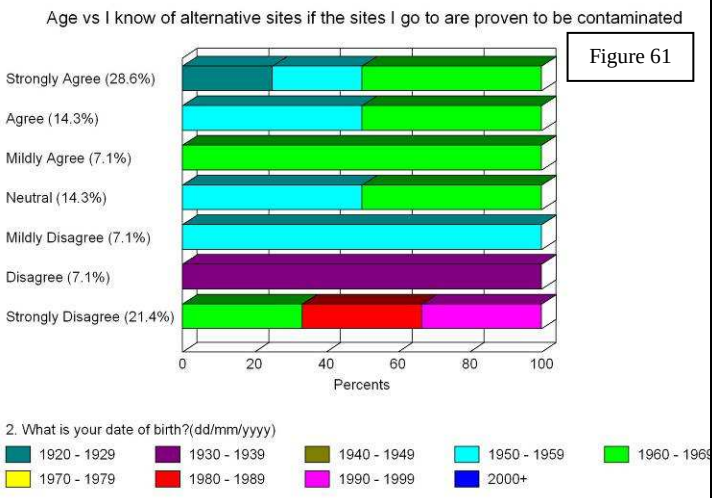


Figure 61

If a site is contaminated then the expectation would be that alternative sites would be used.

However only 50% knew of alterative sites that they could use (Figure 61). 28.6 strongly agreed.

Rangatahi and tamariki disagreed strongly indicating that they did not know how to change their behaviour and gather from alternative sites.

Whanau commented that:

The size of the lagoon has decreased because of drainage. At Temuka it used to be made up of 99% of swamplands and streams and places where eels used to be and watercress up the side but it's all drained and dry now. Creeks around the farms have been drag-lined and they

clean them out every two or three years so there is no place for the eels, no habitat and whitebait have no breeding ground. So that is why they are going down.

Washdyke we don't go there anymore because of industrial waste and if you go there it's for little as possible. You wouldn't go with all the pollution from the boats and things in harbour.

Tuna we are more worried about now because its the only thing left to us. The kanakana I go further afield because the habitat is not there anymore. The rivers are so low there is no soil banks they used to settle in to. Likewise with eel there is no real place for them anymore so their habitat has changed.

Because of low levels of river when gathering kai, like kanakana, you have to make sure the mouth is open and if its not to get same kai you have to go to Waihao.

The [taint] its worse with flounder and whitebait that's why I go to Orari now for whitebaiting. I would rather whitebait at Opihi but if water sits there for weeks and you catch it you can taste it and smell it when you eat it. Since the dams been up there the water quality down here has been bad.

5.2.10 Health of whanau members – Self Reported Rates of Diseases

Participants were asked to self report diseases prevalent in the family (Figures 62 and 63).

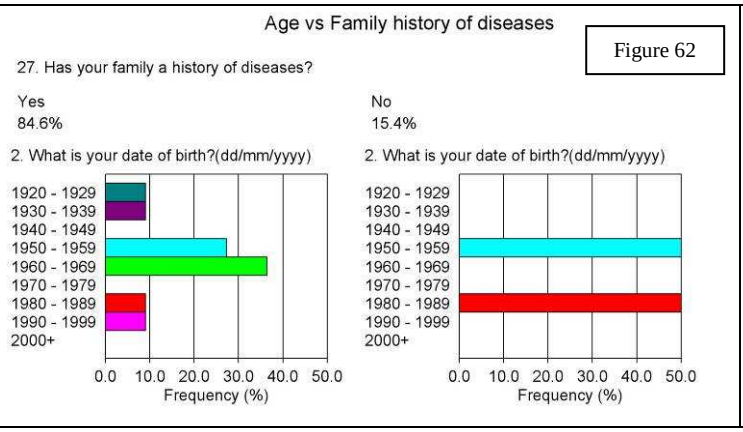
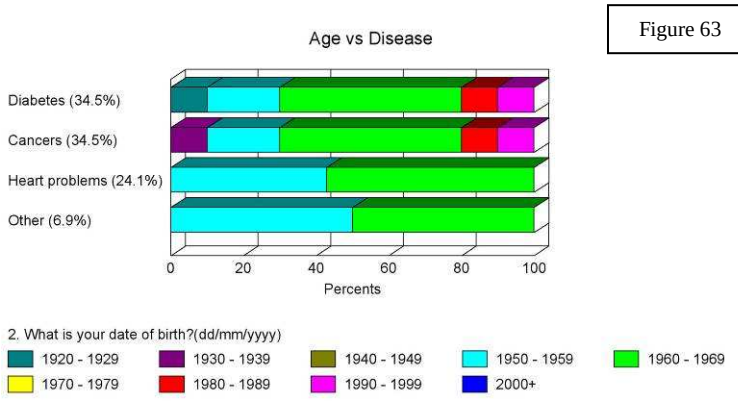


Figure 62

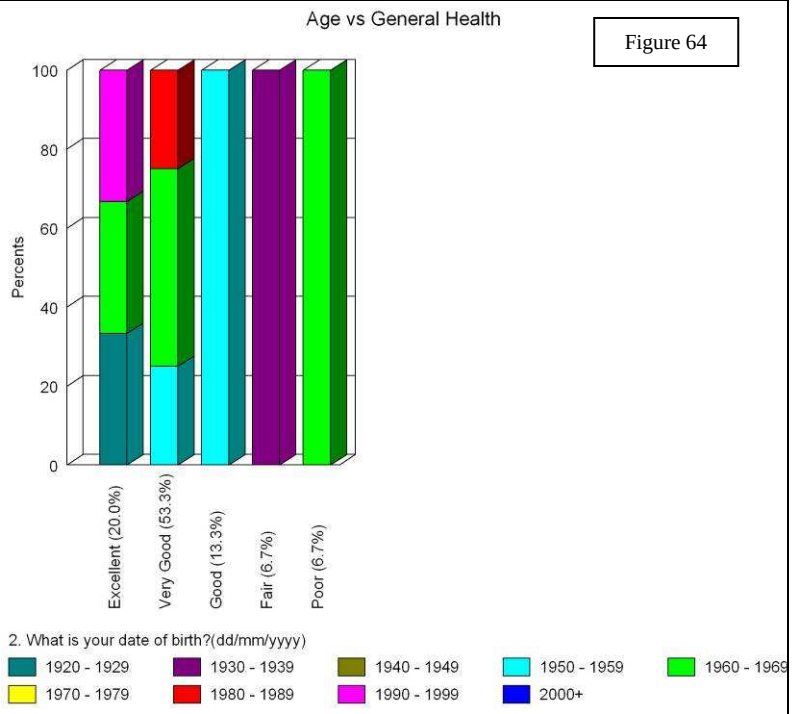
- 84.6% reported that there was a history of disease in their family.
- 34.5% of participants, across five age groups, reported a history of diabetes within their whanau.
- 34.5% of participants, across five age groups, reported a history of cancers within their family.

Figure 63



- 24.1% of respondents, all aged between 40-59 years, reported health problems.

Figure 64



Despite the prevalence of illness in their whanau (at above average rates) 87% of the individuals participating rated their health as good, very good or excellent (Figure 64). Only two of the respondents (one aged 70-79 years and the other 40-49 years) rated their health as fair or poor respectively.

Other age group observations:

- The eldest participant considered their health as excellent.
- All those aged 50-59 years rated their health as good or very good.
- The greatest variation was in the 40-49 years age group with participants rating their health poor, very good or excellent.
- As expected, the youngest participants (aged 10-29 years) considered their health very good or excellent.

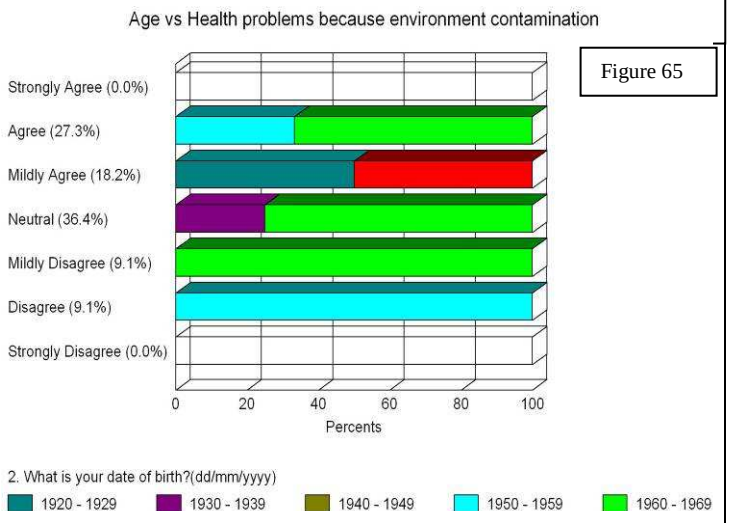
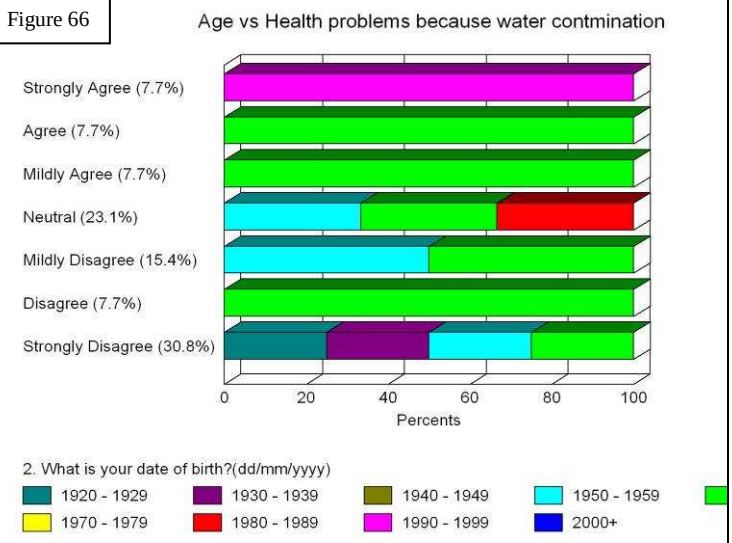


Figure 65

Two questions in the survey asked if respondents believed their health problems could be attributed to environmental contamination or more specifically water contamination (Figure 65).

With respect to environmental contamination, a third were neutral, while 45% of participants across most age groups agreed with the statement. Only those aged 40-59 years of age disagreed with the statement that their health problems were the result of environmental contamination.

Figure 66



Interestingly the majority of participants (53%) disagreed with contaminated water being the source of their health problems while another 23% provided no comment (Figure 66).

Kaumatua strongly disagreed.

5.2.11 Disseminating advice about contamination issues

One of the outputs of this research is to be a risk assessment framework. If it is to be implemented effectively it needs to reach grass roots Maori. A number of questions therefore sought data on how information should be communicated and who should be responsible for delivering the message.

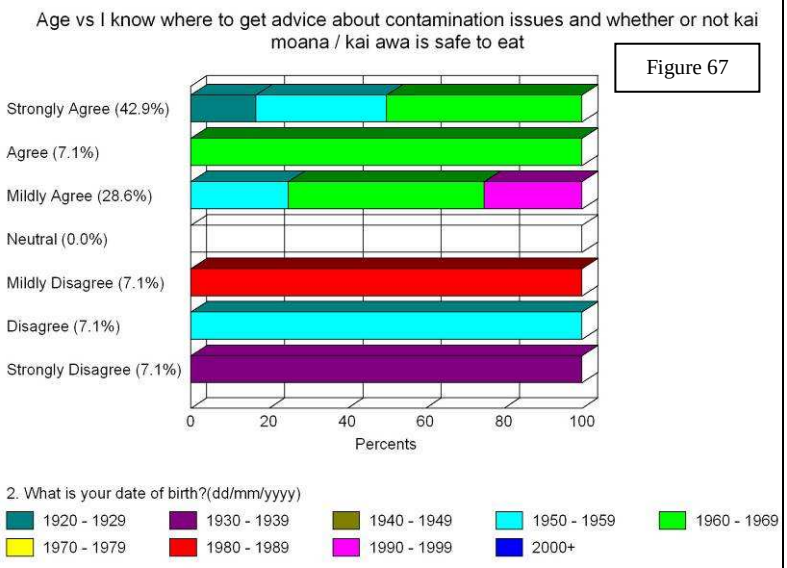


Figure 67

42.9% of respondents indicated they definitely knew where to get advice about contamination issues (Figure 67).

A further 35% responded less confidently but also said they knew where to get information from. Only 21% (and two specific age groups – rangatahi and Kaumatua) did not know where to go to obtain information.

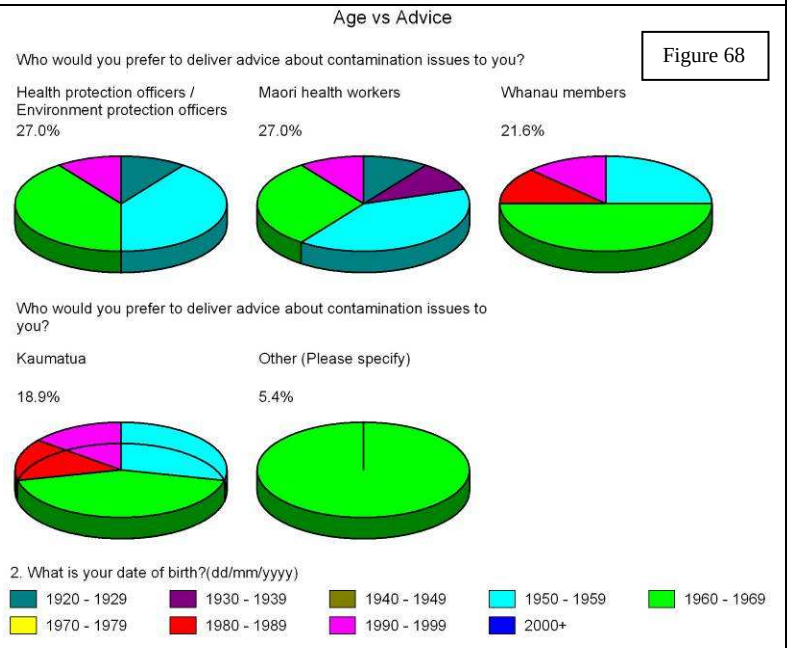


Figure 68

There is no clear preference for who should deliver the information, with similar preferences given to: HPOs/EPOS, Maori health workers and whanau members (Figure 68).

Similarly there was no clear preference with respect to the means of communicating which in fact suggests that a

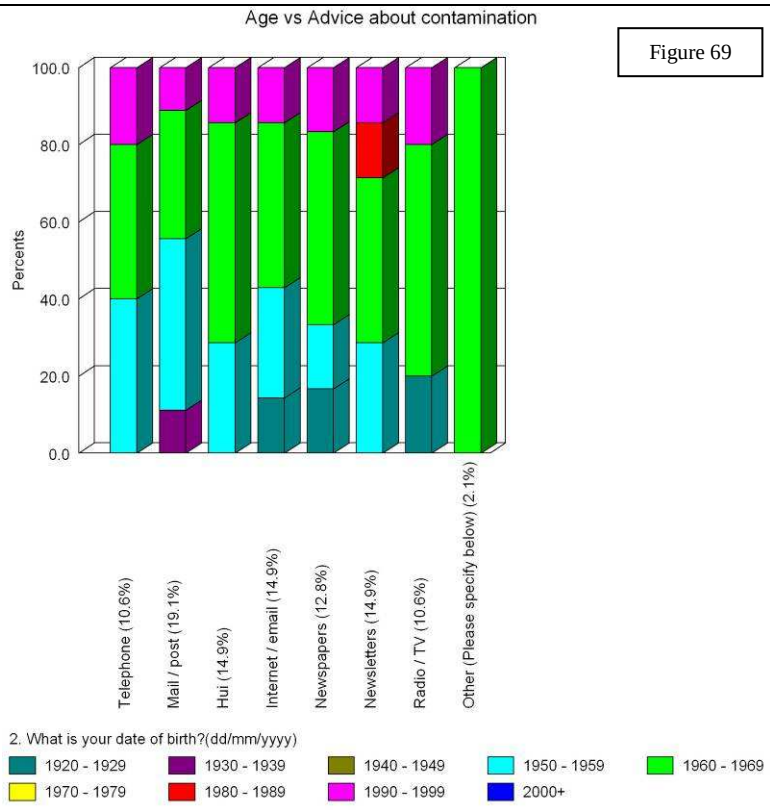


Figure 69

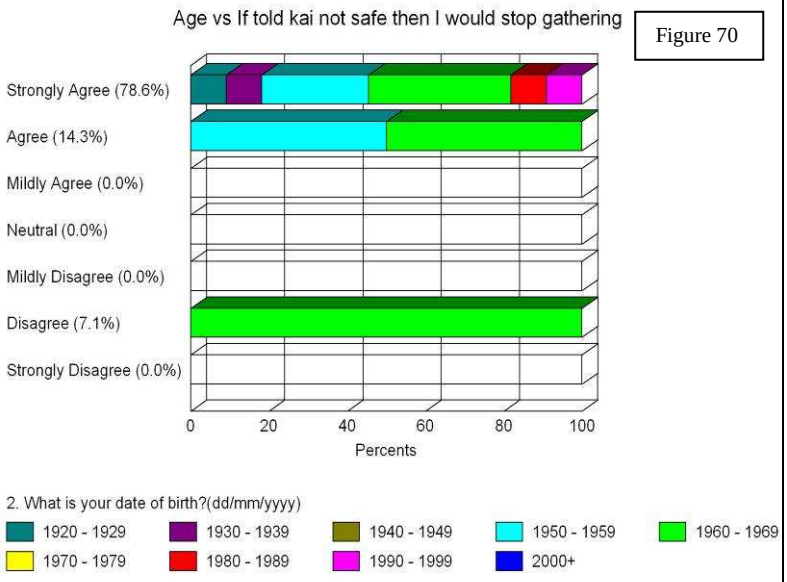


Figure 70

range of media should be used (Figure 69).

When reviewing the means of communicating we need to be cognisant of the equipment needed by whanau. Although not specific to South Canterbury, at the time of the 2006 Census:

- 66 percent of Ngai Tahu lived in a household with Internet access, an increase of 26 percent from 2001 (40 percent).
- 85 percent of Ngai Tahu lived in a household with access to a cell phone.
- 2 percent of Ngai Tahu lived in a household with no access to telecommunication devices (cell phone, telephone, and Internet or fax machine).

- The final result (Figure 70) concerns the long-term outcome of this result programme. Importantly, 93% of respondents (across all age groups) indicated they would stop gathering kai if advised that kai was not safe.

6. Discussion - understanding the socio-economic-cultural importance of kai to whanau and hapu

> *Indigenous relationships to the land are based in cultural practices. Harvesting of traditional foods is a central, material part of this relationship. A key problem for indigenous peoples occurs when, because of the practices of competing world views such as those often held by colonial states, practising these material connections becomes difficult. Problems ensue. These problems include issues related to health and well-being, and a disruption of well-established life-ways.* (Fediuk & Thom, 2003, p 1)

The discussion in this chapter re-examines traditional and contemporary consumption patterns of kai gathering, processing and consumption, the health of significant sites, and environmental change over the last 160 years to identify drivers of the transitions from a traditional kai based diet to a western diet. Insights, firstly, concerning the impact of dietary changes and secondly, the ongoing risk of exposure to contaminants and the impacts of this risk on the health and wellbeing of whanau are discussed. We have attempted to discuss these impacts in the wider political/social/cultural context in order to give a more complete reporting of cultural-environment relations.

6.1 Research results in the context of international literature

We have tried to convey the contradictions and challenges that surround the issue of contamination of kai:

1. Kai gathering contributes to the health and well bring of Maori by sustaining many cultural beliefs and values central to the identity of hapu. However the gathering of contaminated kai could be having a significant adverse impact.

2. Furgal (2003a) explains that the idea that potential health risks are associated with foods and a way of life previously regarded as “safe” has proved difficult to convey to Aboriginal peoples in North America. The individuals to whom risk information about the safety of their foods is to be conveyed have grown up living, hunting, and travelling over lands and rivers in a harsh and sometimes dangerous environment. Maori find themselves in the same situation of having to re-learn what is “safe” and what represents a health risk for them.

6.1.1 Structure of this chapter

Ngai Tahu have continually asserted their right to have their mahinga kai practices protected. However, many whanau in South Canterbury have witnessed the degradation of valued habitats and experienced significant barriers to gathering kai. They continue to express their concerns in a variety of fora. This chapter follows the format of Chapter 5 and discusses:

- patterns of kai consumption;
- estimates of the quantity of kai consumed;
- sites from which kai is gathered;
- preferred kai species;
- perceived changes in the abundance of species;
- kai gathering behaviours;
- perception of the environment;
- health and wellbeing of whanau members; and
- disseminating advice about contamination issues.

6.1.2 Patterns of kai consumption

Data from the 1879-1880 map prepared by Ngai Tahu Kaumatua was discussed in Chapter 5. This manuscript identified sites from which kai was gathered. This manuscript detailed of over 100 resources that were utilised. Analysis of the 1880 manuscript enables us to distinguish the following species sourced in South Canterbury. Of the 38 species identified there were:

- 3 species of shellfish
- 6 species of other freshwater fish
- 7 species of marine fish
- 3 species of birds

- 2 species of sea mammals
- 12 species of plants
- 5 ‘other’ species

Maori who relied directly on their knowledge of lands and rivers within their takiwa for food had access to aquatic species (eels, kanakana, waterfowl), terrestrial species (wild plants, berries, roots, and pollen), and the small game (e.g., rats) that were plentiful and sustained whanau and hapu. Figure 6 showing the location of reserves and easements depicts the scale of loss experienced by Maori following settlement. Historically a surplus of food was gathered as surpluses enabled whanau to access other resources through bartering, trading and gifting (and setting up reciprocal obligations). During the year whanau visited neighbouring hapu, taking surplus food to share. The practice of kai-hau-kai was a central feature of Ngai Tahu culture. Being able to gather abundant foods and thus able to engage in a range of economic practices ensured whanau had access to a variety of foods. Because of trade, however, people weren't restricted to kai immediately available to them from their local area but had access to a wide range of foods. When compared to the range of sites in Figures 4 and 5 it is apparent that Maori were denied access to a significant percentage of their traditional sites of kai gathering across South Canterbury and limited to a number of small reserves and easements located in the lower reaches of streams.

Indeed, many of the valued species gathered historically that were of high nutritional value are no longer available in quantities sufficient to enable them to be a primary food source. As Table 8 confirms most species are seen to be a “lot fewer” in abundance and many iconic species are now only consumed on special occasions. When the perception of species abundance is coupled with the species most commonly gathered in Table 3 and the preferences shown in Table 7, the decline of the eels resource is of particular concern. Sadly as one informant advised, kai is also often purchased for these special occasions – not gathered. Further, the condition of the kai may be compromised as well. Most distressing and representing a significant cultural loss, is the loss of entire species e.g., grayling, koura from some streams, weka.

While whanau made use of many species, the centrality of eels as a critical food source in South Canterbury is well known and reflected in the many initiatives across Te Wai Pounamu to restore populations. As Table 3 shows 72% of sites yielded eels. The current threatened populations of eels, especially longfin, contrasts with their abundance historically. Although some resources were gathered seasonally, historically whanau relied on eel year round.

Food security implies adequate access to affordable, high quality foods that are culturally acceptable. Although Table 3 showed that turnips and potatoes were grown by whanau once they were introduced to the south, this needs to be placed in context. Introduced crops could be grown in the south and a number of cultivations were established.

However, as explained in Chapter 5 introduced aquatic species were not seen as favourably and as the witnesses to the Waitangi Tribunal confirmed, introduced aquatic species were not seen by Ngai Tahu as substitutes of equivalent cultural, spiritual or nutritional value. It was therefore of interest that trout was noted as a preferred species by some respondents in the Kai Consumption Survey.

However if this is the abundant species and requires less catch effort than the declining indigenous species gathered historically, it is inevitable that some substitution occurs. It is clear from our research that whanau currently gather kai at quantities less than they did historically and at quantities less that they desire. This is discussed in the next section.

> *For eels. Full moon or any moon is out then you don't go out. If the moonlight touches the eel then it goes bad before you eat it so we don't go out during moon time.*
>
> *We restrict where we get kai like the wharf area or the outlet for sewage system or Temuka where the old wool scour was or where the settling ponds are because they sometimes overflow so we don't gather there. Or at the site where Temuka dump was we didn't gather.*
>
> *When at moana you don't eat the kai where you gather it and there are sites you avoid.*

6.1.3 Estimates of the quantity of kai consumed

There is little data available to enable calculation of pre-European contact per capita consumption of kai. Even if it was possible to determine harvesting levels for particular species, it is difficult to calculate how much food (and what species) on top of this would have been received as a gift or obtained through trade. For the calculation set out below in Table 10 we have assumed that historically fish would have been consumed on average once per day.

From interviews we know that wild source kai was consumed "at least 3 times" per week up until the 1970s and 1980s. Some whanau, however, eat kai daily. However a crucial time period – around the 1970s and 1980s – marks a significant change in the quantity of kai consumed as interviewees confirmed that more convenience foods

started to appear in whanau diets. Again to enable a calculation of kai consumption in the mid twentieth century we have assumed kai was consumed 3 times per week.

With respect to contemporary consumption, from the Kai Consumption Survey, 90% of respondents still consume kai awa, kai roto, or kai moana. For the comparative analysis in Table 10 we have extracted the quantities of fish consumed from the Kai Consumption Survey data as well as the frequency data (from Figure 25).

Table 10: Estimates of the quantity of kai consumed.

KAI CONSUMPTION HISTORICALLY	KAI CONSUMPTION UP IN TWENTIETH CENTURY 1970S, 1980S	CONTEMPORARY KAI CONSUMPTION
Assumptions • The data for estimating the quantity per sitting is that relating to "fish fillets[8]" • At least one meal of "wild kai" per day per person • Because of the abundance compared to the present, at least 10% more per setting would be compared to today's per sitting estimates 230.77 g per sitting per day Plus 10%	Assumptions • The data for estimating the quantity per sitting is that relating to "fish fillets" • At least 3 meals of "wild kai" per week per person • The quantity per sitting would be the same as today's per sitting estimates of 230.77 g	Assumptions • The data for estimating the quantity per sitting is that relating to "fish fillets" • The quantity per sitting would be the same as today's per sitting estimates of 230.77 g • Special occasions are estimated to be 6 per year. • 9% eat kai on special occasions • 9% eat kai average 2 times per month • 36.4% eat kai once per week • 27.4% eat kai twice per week.
Equals 253.85g per person per day	**Equals 98.90g per person per day**	**Equals 43.81g per person per day. This is higher than the average New Zealand consumption of 32.87g per person per day (Kim and Smith, 2006).**

The quantities for other species are considerably less.

- Contemporary consumption of whitebait — **Equals 7.48g per person per day**
- Contemporary consumption of mussels — **Equals 11.14g per person per day**

The Kai Consumption Survey asked respondents to identify quantities of various types of kai consumed. For the preferred species, as recorded in Table 6 the following observations can be made:

- The quantities available fall far short of levels desired by whanau who wish to engage in mahinga kai practices. The only two species that possibly approach

[8] It is assumed that the "fish fillets" estimate would apply for butterfish, greenbone, kanakana, eels, founder, hapuka, mullet, kahawai, kingfish, gurnard, snapper, moki, shark, trevally and trout.

adequate abundance are mussels and shark which respondents confirmed were available and often sourced from the supermarket or takeaway.

- It can be seen from Table 7 that for almost every species, the majority of respondents believed that populations were declining.

- The majority of kai is now only consumed on special occasions.

6.1.4 Sites at which kai gathering and other activities are undertaken

Major changes in mahinga kai behaviours began some 160 years ago with European settlement. Newly introduced foods replaced wild sourced kai principally because of the relocation of whanau and hapu to reserves, their assimilation in the mainstream New Zealand culture, and damage to the resource base resulting from use and development of resources by the newly arrived settlers. Interestingly many of the sites still utilised by whanau as shown in Figure 30 are found in close proximity to reserves and easements.

Although the initial loss of land occurred in the mid eighteenth century the interviews with whanau members (especially kaumatua) confirmed that they gathered many species until relatively recently and they believed that the most damaging changes occurred within the last generation. These observations confirm the period of 1970-1980 as a time of change.

The alienation of lands and resources has seen the mahinga kai practices of Ngai Tahu transformed. This transformation occurred at a time when resource degradation and environmental crises have precipitated the search for alternatives to dominant management systems (Berkes, 1991, 1994; Pinkerton, 1989; Stevens, 1998). Traditional knowledge, (or in the New Zealand context Matauranga Maori) is increasingly promoted as a valuable addition to scientific knowledge. However it must be recognised that the application of Matauranga has been disrupted and subject to interference. Nevertheless for some whanau, for some resources, in some areas, there has been regular, relatively uninhabited resource use through the generations. As the interviews and Kai Consumption Survey show many Ngai Tahu continue to gather and consume kai awa, kai roto and kai moana.

The fact that kaumatua contend that the most damaging changes have occurred in the current generation, when considered alongside the data showing that the 10% of respondents who don't eat kai are all rangatahi, suggests the assimilation of Maori into mainstream New Zealand lifestyles and diets is continuing. It also suggests that the loss of some mahinga kai practices may be quite marked in younger whanau members.

In South Canterbury, the declining abundance of aquatic species at many sites is attributed to water quantity issues arising because of excessive extractions, changes in flow patterns as a result of damming, and demands to divert or drain waterbodies. This clearly has the potential to place Ngai Tahu in confrontation with development interests as:

- the streams valued and utilised by Ngai Tahu are those most stressed;
- currently 88% of water allocated in Canterbury is used for irrigation; and
- Ngai Tahu believe some of the current land uses (that are totally dependent upon water supply) are unsustainable.

Two graphs from the Canterbury Strategic Water Study (Lincoln Environmental 2002) highlight the concerns of Ngai Tahu. Figure 71 shows that for irrigation, the Orari / Opihi catchment provides 5.7% of the total maximum allocated weekly rate of take. Yet as Figure 72 which follows shows, collectively the Orari and the Opihi represent only 1.3% of Canterbury's surface water resources under low flow conditions.

From Figures 35 to Figures 44 in Chapter 5 it is clear that many of the sites utilised by whanau are found in these catchments. Another more extreme example has the Ashburton providing 19.6% of the total maximum allocated weekly rate of take, while representing only 2.4% of Canterbury's surface water resources under low flow conditions.

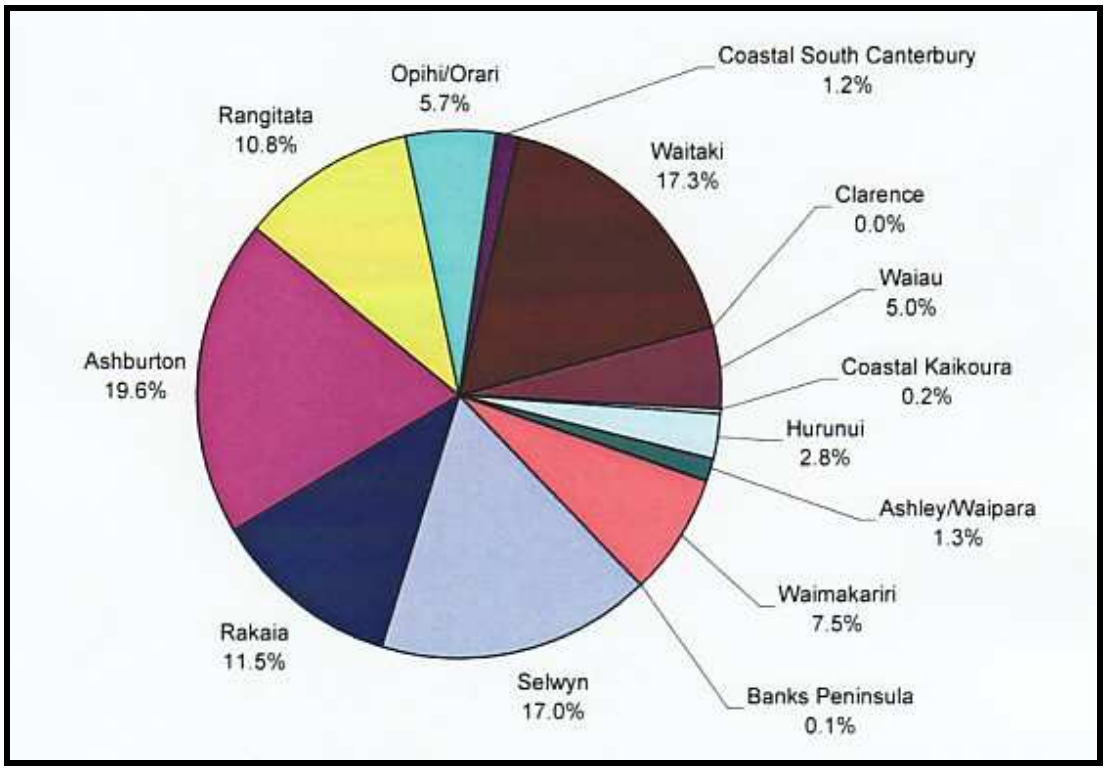


Figure 71: Proportion of total maximum allocated weekly rate of take that is supplied by each of Canterbury's water resource zones (Source: Lincoln Environmental 2002).

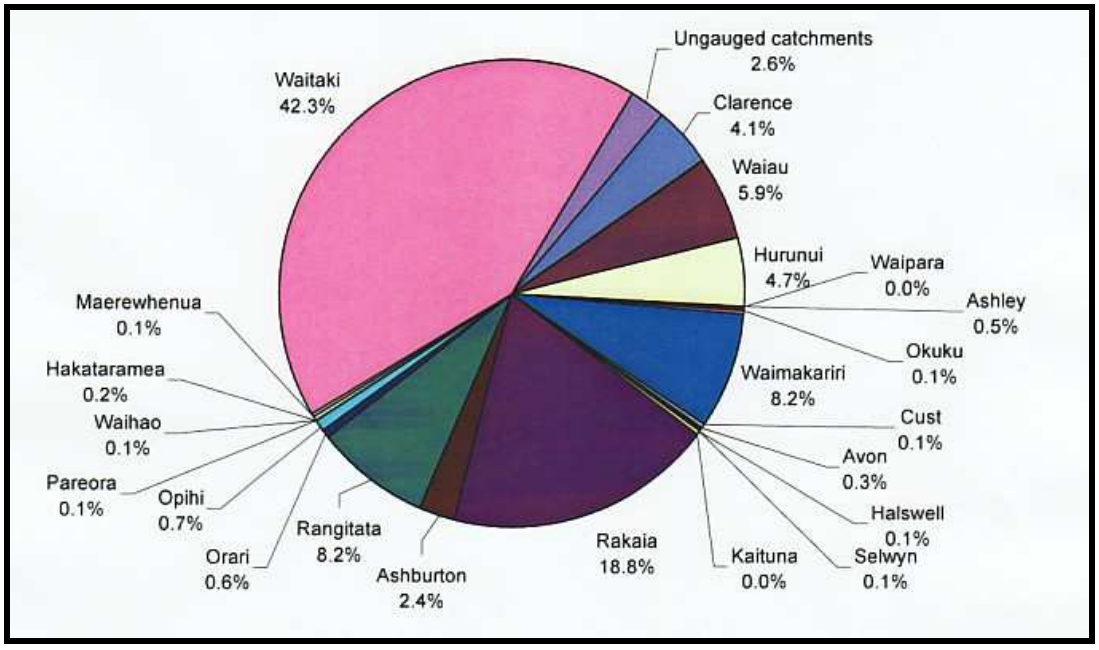


Figure 72: The relative size of Canterbury's surface water resources under low flow conditions (Source: Lincoln Environmental 2002).

While the previous two figures focused on surface water, Table 9 summarises the allocation of groundwater in the respective catchments and also confirms that the smaller catchments used and valued by Ngai Tahu are stressed.

Table 9: Revised Groundwater Allocation Summary[9]. **Issued** = granted consents outside any appeal or objection period. **Decided** = granted consents in the objection or appeal period, and consents that have been objected to or appealed. **In process** = applications for which no decision has yet been made. Total amount of groundwater currently allocated exceeds the allocation limit. Total amount of groundwater currently allocated is 80% of the allocation limit. Total amount of groundwater currently allocated is less than 80% of the allocation limit.

Zone	Allocation limit (million m^3/yr)	Effective allocation (million m^3/yr)				Zone status	
		Issue	Decided	In process	Total	Current & decided	In process
Ashburton River	69.5	69.41	0.00	10.17	79.58	100%	115%
Ashburton-Lyndhurst	126.6	128.79	0.00	8.25	137.03	102%	108%
Fairlie	37.0	4.58	0.00	0.00	4.58	12%	12%
Levels Plain	32.9	24.84	0.24	0.00	25.07	76%	76%
Makikihi	18.05	18.06	0.00	0.00	18.06	100%	100%
Mayfield-Hinds	148	125.68	0.00	5.09	130.77	85%	88%
Orari-Opihi	71.1	71.01	0.00	0.64	71.65	99%	101%
Otaio	4.93	4.76	0.00	0.00	4.76	97%	97%
Pareora	9.38	9.79	0.00	0.54	10.34	104%	110%
Parnassus	12.8	5.49	0.00	0.00	5.49	43%	43%
Rangitata-Orton	42.5	43.99	0.00	2.85	46.84	104%	110%
Valetta	96.6	106.10	0.84	29.41	136.34	110%	141%
Hook	2.49	2.87	0.00	0.80	3.67	115%	148%
Waimate	8.18	7.79	0.00	0.92	8.70	95%	106%

Interviewees believed that summer withdrawals leave some stretches of riverbed almost dry. The water is left dribbling in channels and gets lethally warm and polluted with agricultural runoff. Fish migration – upstream and downstream – is also severely compromised. In some catchments fish survival is dependent on access to isolated and disconnected large pools. Of particular relevance to consideration of contaminant levels, is the reduced assimilative capacity of waterways when only minimum flows are maintained – often for significant periods of time during summer.

[9] Sourced: Environment Canterbury http://ecan.govt.nz/services/online-services/monitoring/groundwater-allocation/Pages/groundwater-allocation-summary.aspx downloaded information was last updated 2 August 2010.

Interviewees expressed concern that both the regional council and Government seem to support and prioritise the beneficial use of water. Water has been allocated for agricultural purposes and these rights are defended vigorously. In contrast, non-agricultural purposes, such as leaving water instream to protect instream values, was and is still designated by some as "wasteful"[10]. From the perspective of Ngai Tahu the prejudice in favour of agricultural usage is still enforced. It is interesting to note that with respect to surface water flows, the following rivers are classified by Environment Canterbury as flow sensitive[11]:

- Opihi
    - Opuha (inflow to the lake).
    - Opihi.
    - Temuka River (Hae Hae Te Moana).
    - Kakahu River (upstream of Hall Road).
    - Tengawai River (whole catchment).
- Otaio – mainstem upstream of Otaio Gorge plus St Andrews Stream.
- Pareora River – catchment upstream of Pareora Huts and Taiko Stream.

Of concern when reviewing Figures 70 and 71, together with the summary of groundwater allocations in Table 9, and the list of flow sensitive surface waters are the catchments that are flow sensitive is hat many appear to be fully allocated or over allocated. To reiterate, all catchments that are valued and utilized as mahinga kai by Ngai Tahu are affected by low flows.

Other evidence to the Waitangi Tribunal by Ngai Tahu describes fish kills in rivers, while interviewees describe changes in the water quality and a deterioration of the condition of kai gathered. Decreased water quality is definitely a cause of denied or limited access to kai. Fertilisers and agricultural pesticides used in agriculture, especially the intensive agriculture of South Canterbury add to the deteriorating water quality. Table 10 summarises current water quality for some of the river used by whanau. Despite these assessments confirming water quality concerns, the waterways in Table 10 are still used by whanau (as shown in Figures 35-44).

[10] Sentiments expressed directly to whanau members – one by a Environment Canterbury staff member but more commonly by agricultural interests.
[11] Flow sensitive is defined in the Natural Resources Regional Plan as "a catchment that is vulnerable to reductions in summer low flows as a result of a change in the vegetation cover from short to tall vegetation.

Table 10: Environment Canterbury monitoring at swimming sites across Canterbury[12].

Catchment	Location	Result
Otaio River	Otaio Gorge	Fair
Opihi River	Saleyards Bridge	Fair
	Temuka River	Fair
	SH 1	Good
	Waipopo Huts	Fair
	Te Moana Gorge	Fair
	Waihi Gorge	Fair
	Lake Opuha – Dam boat ramp	Very good
	Lake Opuha – recreation reserve	Fair
	Lake Opuha – Ewarts Corner	Poor
Orari River	Gorge	Good

More recently Ngai Tahu have been denied access to kai due to increased gathering pressure by ethnic groups who either do not know or respect the tikanga and/or rules that regulate gathering.

In summary the sites still used by whanau are coming under increasing pressure - two types of pressure are being experienced:

- pressure on the use and development of aquatic waterbodies; and
- pressure on the aquatic species themselves.

In South Canterbury this pressure has led to conflict over the extent and impact of resource depletion and degradation.

As whanau explain:

> *Around the Waipopo area, from the Opihi River up, to Pleasant Point we would use the river for eeling, kanakana, floundering, yellow eyed mullet, herring. Around the mouth we would fish for kahawai.*
>
> *Around the Orari mouth we would use it for whitebaiting.*
>
> *Temuka, Opihi area is what we used for eeling. Right the way out to Winchester.*
>
> *Waitarakao was the name of Washdyke Lagoon…. My sister, me and her used to travel around there around gather flounders which used to be in the rocks. We used to gather karengo at certain times of the year on the rocks there. There were also eels taken there and whitebait … Kanakana was a favourite there and it's still there even though the*

[12] Environment Canterbury web page www.Environment Canterbury.govt.nz, downloaded 15 April 2008.

industrial area of Timaru has dumped a lot of its stuff into that area and it's considered polluted. So we don't go there as much now.

6.1.5 Preferred kai species

The principal foods from the Arowhenua archival data were from the main nutritional groups. As Williams (2004) explains:

- Kauru is a carbohydrate (and historically was gathered from 24% of sites).
- Eels are primarily a source of fats, but also sources of protein (gathered from 71% of sites).
- Mata/inaka, waterfowl and the Galaxiids are predominantly protein.
- Forest birds, kiore, kiwi and weka, combine protein and fat.
- Pora was a green vegetable.
- Aruhe was largely a "filler", eaten for bulk, and of low prestige; as was koareare.

Historically whanau and hapu consumed eels and titi as their main sources of fats. These were available in their greatest quantities in late autumn and early winter. Kanakana were a subsidiary source of fat. However South Canterbury was renowned for its kauru. As the main source of carbohydrate, great quantities of kauru were prepared. There is no record that kauru was preserved for consumption at a later date (Williams 2004), although McCallum (2007) describes how it was processed. Tikao describes the confectionaries made from kauru including fruit juices used as flavourings, and a type of jelly made with agar.

In contrast, the data from the Kai Consumption Questionnaire identified the contemporary preferences. Surprisingly, the top 6 according to the ratings (in order of preference) were:

1. snapper, koura.
2. kina.
3. trout.
4. pupu, pipi, cockles, herrings, oysters.

Eels which had been sourced from 71% of sites historically rated only 15th as the preferred food. However this is likely to be a reflection of how difficult they are catch because of their scarcity.

6.1.6 Seasonality of kai gathering

The following figures prepared by Anderson (1983) and Dacker (1990) illustrate the historical seasonal food gathering patterns for the southern region. Although some whanau adhere to these seasonal regimes, the technology (in particular the gear) available to fishers means that resources can be gathered all year round.

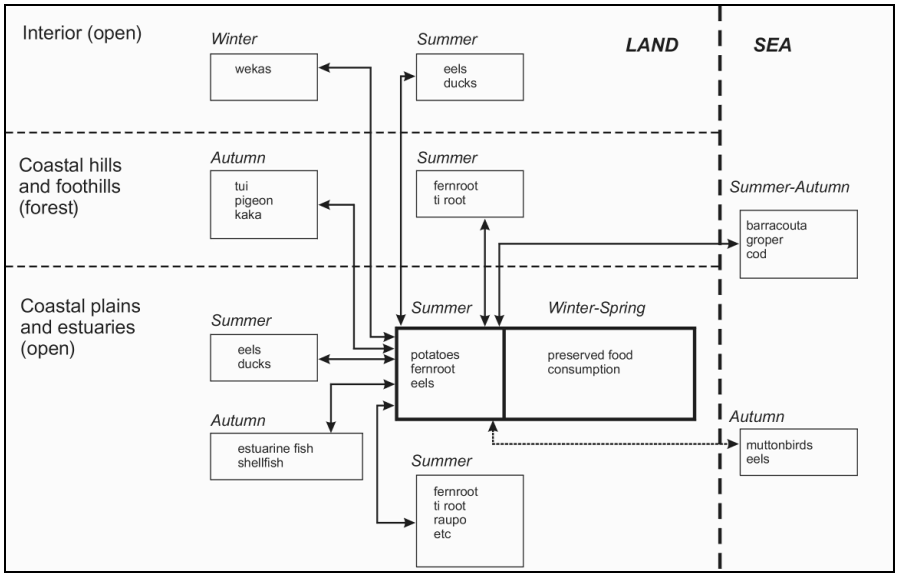


Figure 73: Seasonal Patterns of gathering (extracted from Anderson (1983:43, 1995:117)).

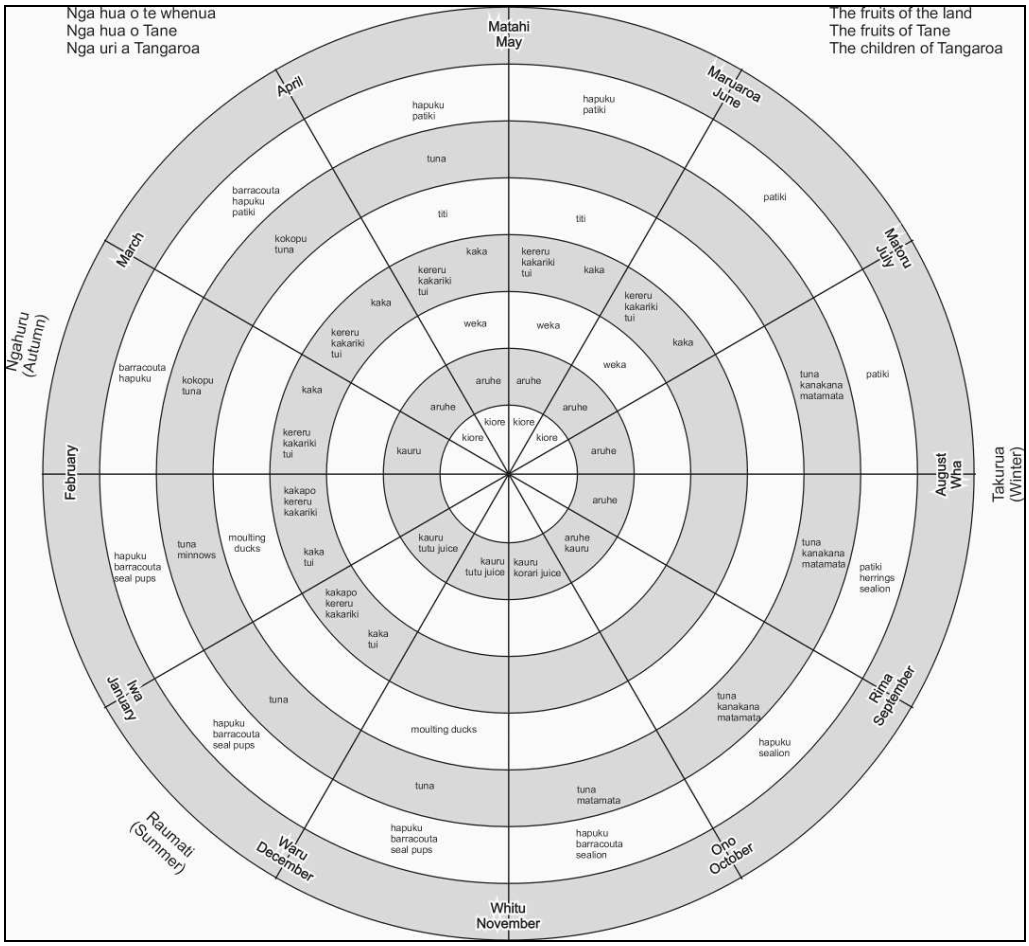


Figure 74: Seasonal Patterns of gathering (extracted from Dacker (1990:10-11).

The following Table has been compiled with the data from the Kai Consumption Survey identifies the seasons when species are gathered today.

Table 11: Seasonal kai gathering patterns today.

Species	Summer	Autumn	Winter	Spring
Herrings	■			■
Lamprey	■	■	■	■
Eel	■	■	■	■
Flounder	■	■	■	■
Paua	■	■	■	■
Mussels	■	■	■	■
Mullet	■			■
Kahawai	■	■		■
Moki	■			■
Shark	■			■
Whitebait				■
Trout	■	■		■
Kina	■	■		■

Key:

■ All the seasons when gathering occurs

■ When the most gathering occurs

Whanau commented -

> *It was all year round because the kai gathered from awa and moana were not supplementary but were essential.*
>
> *Eel have become lesser quantity and hard to get. We believe it's from commercial fisherman and they [eels] are smaller.*
>
> *About twice a year for eels and it really just to see what's there, its information gathering, because I just want to see if it's come back or if its better or if size of eels increased. I went out twice last year and you wouldn't spear as it wasn't big enough and it would be criminal to take. We just had a look around above lagoon to Railway Bridge in a night and it was a sad state of affairs. We hope things will get better.*
>
> *Kanakana is a little different as they are on a migratory thing as they in to breed in the mountains and they don't muck around. Between here and Railway Bridge (Opihi) it's a nights travel so if they come through early in night they will get to the Opihi Bridge and if they come in later then that's where I get them down here and stay in that ground so that why we go out at that time. Same thing at Washdyke they travel that quickly so anything in that line it only has come in that night so hopefully it's not polluted when we gather. Kanakana again it's sad it's hard to get and if you do get one it's a treasured source of food but more than that it good to see they are still there.*
>
> *Watercress is seasonal is usually goes with the frost but there are some spots under the willows.*

6.1.7 Processing of these preferred species

The processing of kai species also needs to be understood if all possible pathways of contaminants are to be identified. In this section only two species are discussed and the means of processing described.

1. Eels were often preserved as pawhera eels. The skin, backbones, heads and tails were removed and the eels hung out to dry. Curing them like this preserves them for months. For eating, they are softened by steaming. This process is called "pawhera". After this the eels are partly cooked and again dried. Flesh treated in this way could be stored for three years.

2. Titi (mutton birds) have long been an important food for Ngai Tahu, especially southern Maori who have control of the birding rights. Titi is a prized food. Once the chicks are collected, they are plucked and then the feet and wings are cut off. They are then dipped in wax to help remove the layer of down on the bird's body. Once hardened, the wax is cracked and removed, taking the down with it.

- "Poha titi" refers to the process of preserving the birds, whereby the hot fat retained from cooking the birds is poured into a kelp bag or kete and allowed to set, the flesh of the birds inside the pōhā is preserved for a very long time.
- Another method of processing is for the birds to be packed in salt and placed in buckets for shipping to whanau or to markets on the mainland.

Whanau also explained -

River and creeks used in that for rotten corn as well as fermenting spuds. We used to put them in there and brought them out and the smell was very strong.

They [tuna] were the main staple of our diet. Getting eel to supplement the table….. putting them in the deep freezer for the winter.

Anyway bring home tuna and clean it up myself.… I smoke some of mine and some I boil up in pot with watercress. The Maori boys showed me how to cook eels with watercress.

6.1.8 Perceived changes in the abundance of species that are gathered

A number of questions on the kai consumption survey sought to determine of the reasons for the dietary changes. The quantitative data summarised in Table 7 suggest the declining abundance of aquatic species in rivers is one of the main causes of diet change. However interviewees also reported degradation of aquatic environments, loss of access as a result of land tenure change, societal change (more specifically working longer hours) and government regulation as barriers to their engagement in mahinga kai activities.

Whanau were able to identify changes to different species -

A species that disappeared from when we were younger is koura. You would be lucky to see one. When we were young we would play in the creeks right down to the pa and we would take them home in jars. We can blame it on pollution in the Temuka River and they don't like that.

Amount of white baiters and the river systems have altered and the breeding ground along the side where they traditionally laid there eggs is just not there anymore and that's major reason.

Farming has changed this with drains being cleared out and the native grasses on edges are gone from banks and all you have now is a stream running through shingle.

For eel to gather half a dozen in half an hour and same with mussels back then. 10 mins on a reef there you would get enough.

When I went out early this year to get eel we went out at 8 pm to 2 in morning we only got 5 eels. Before you would have got that in 1 hour. Had to travel quite a bit to find them and the river has changed a lot since back then with a lot less water and there used to be a lot of holes where you could fish from but now you don't see that.

Loss of the numbers of eel and it's from commercial eeling because we used to find a lot of nets down river and we used to cut them up and let them go. And they got cunning and we can't find them now.

We don't seem to get the bigger eels. Four inches around anymore with them being a lot smaller now. Six of them used to be enough but with the size now you probably need 12 of them to get a decent feed.

6.1.9 Kai gathering – its contribution to wellbeing

The concept of mahinga kai extends beyond the nutritional value of species and its physical health benefits to encompass a range of cultural values. It describes species available locally and encompasses the cultural values attributed by whanau and hapu to these species as each is gathered, processed and distributed according to tikanga and kawa. Some of these values are discussed, albeit briefly, in the paragraphs below.

Whakapapa - Whakapapa is an important conceptualisation for Maori. Whakapapa is also central to kai gathering, which like many other cultural activities, is built around collective action (Ireson 1992, 1996). This is highlighted in South Canterbury where rights of manawhenua determine access to reserves and fishing easements.

Whanaungatanga - Kai gathering afforded opportunities for whanaungatanga bringing whanau together and enabling values and information to be transmitted from one generation to the next. A central tenet of whanaungatanga is to care for kaumatua and those unable to gather for themselves. After kai is gathered it is eaten together in groups of family and friends. It is therefore apparent that social capital built up through kai gathering could be more beneficial than those derived from more cotemporary individualistic activities, such as pataka. The development of these initiatives appears to draw upon these notions of social capital for cultural legitimacy.

Wairuatanga - Ngai Tahu and other Maori use different ways to feel spiritually connected with their takiwa. Gathering kai with whanau at a traditional fishing place, that they know was named by their tupuna and utilised by successive generations of their whanau, is one way. Being able to contribute the kai that their takiwa is renowned for, to ceremonies like kai-hau-kai[13] and to manaaki manuhiri can also bring that connection.

[13] Kaihaukai (Williams 2004) suggests breaking down the word kaihaukai into its component parts - *kai* (food); *hau* (obligation outstanding); kaihau ("Acquire property without payment or return made"

Manaakitanga - Although Durie (2004) contends that mauriora is dependent upon a secure cultural identity, diet changes can lead to loss of culture and identity. Having the ability to manaaki visitors by supplying kai sourced from one's takiwa means that the activities of fishing, eeling and gathering other foods creates and maintains community ties and reinforces identity. Conversely the inability to manaaki guests and sustain whanaungatanga can lead to cultural loss.

Matauranga Maori - As has been previously stated, the activities of gathering and preparing kai serves the functions of passing on traditional knowledge from one generation to the next. Matauranga Maori is developed and transmitted through practices of food management, harvesting and preparation. A great deal of knowledge is needed in order to obtain kai - knowledge of techniques and also knowledge of ecosystems. If populations of aquatic species do not return, knowledge of the techniques of gathering these foods along with the associated ecological and cultural knowledge and the process of gathering will likely also begin to disappear. Knowledge of preparation is also important. Yet as food species disappear from the dining table, the particular knowledge of how prepare foods is also lost.

Te Reo - That kai is instrumental to a culture is reflected in the stories and Te Reo that pertain to food. Te Reo contains knowledge and is an expression of culture and identity. Te Reo has been declining for many reasons, one of which may be attributed, in part, to changing lifestyles. When a valued species disappears from a local ecosystem, or the activities associated with a species decrease, the associated Te Reo drops out of usage. When 92% of the respondents confirmed that they would stop gathering if advised that species and sites were contaminated, the indirect cultural impacts that would ensue could represent a significant loss.

Cultural survival - This section has attempted to describe how kai gathering is the glue that binds whanau, hapu and community together, providing a sense of identity that also serves as the vehicle for the transmission of values and knowledge. Mahinga kai probably received more recent attention than any other tribal issue in the Ngai Tahu claim. Archived documents, including evidence previously cited in this report, provides in-depth testimony concerning the cultural and spiritual significance of aquatic kai species and of the water bodies across South Canterbury themselves. If contaminants lead to a further reduction in kai gathering, which is arguably at the heart of Ngai Tahu culture, at stake is nothing less than Ngai Tahu cultural survival.

Williams (1983:87)). Therefore kaihaukai, describes a feast which obligates those who received the feast to reciprocate. Williams (2004) explains that the kaihaukai was rather more complicated than as it was a form of trading, as there was a distribution of surplus food.

Hauora Maori - The presence of kaumatua represents "intellectual capital". They are holders of a wealth of critical information about the past and can draw on this knowledge to provide accurate assessments of environmental condition, including changes over time, at a localised level. The results from the Kai Consumption Survey confirm that differences in behaviours, perceptions and knowledge are found with the different generations. Loss of relationships with the natural world could lead to grief. Many feel whakama when unable to fulfil the social roles expected of their age groups. At stake with the loss of kai gathering is not only cultural survival, but potentially the physical and mental wellbeing of whanau members. The comments of whanau members support the statements above.

> *We learnt that from our mother and she learnt off her grandmother and we have passed it on.*
>
> *Anywhere we were taught to get kai was from mother and this became less and less as she had a great knowledge of what was safe in her head and what wasn't and we follow this.*
>
> *Kai is shared with whanau and extended whanau. If you have anymore than you need you would share. It's such a rarity to get kanakana that you first think of giving it to your elders. This has always been our way with giving away your first lot.*
>
> *Tuna was our staple. Temuka was renowned for tuna… Today there is nothing there in comparison. In those days the quantity there was more than enough and to share with visitors and today we have barely enough for ourselves let along share with our visitors which isn't good.*
>
> *…mainly taught by grandmother and grandfather they show you want to do.*
>
> *Always part of life we were brought up with it. I would love to give the same amount of attention to these areas and have them for my children when they grow up but with the lack of places to do what we want to do like eeling and catching kanakana the environment is not there. Then the whole process of teaching your children the same knowledge from parents and grandparents disappears as well. The whole community feeling of Maoridom goes as well.*
>
> *My children are in Christchurch and they would love to learn and I would love to teach them and they are getting less chance to learn. There is a lot of whanau around us and the younger generations are moving away from the marae and they are not coming back to the rivers and moana to get the food which we gathered with supermarkets being cheaper for them.*
>
> *It mainly for table.… I don't just go and get it for the sake of getting it. I would rather have it fresh.*

We always share what we get with family or with visitors from Christchurch and we would give them some to take away. Always been like that.

First to the kaumatua. That is a practice always it still down now. Even now with watercress and that's done regularly.

We had areas where we went to gather kai and you would see others (whanau). I am one of the only few kaumatua who gather kai. Though some kaumatua may get kai given to them from there whanau. Those practices still going on with some times I walk out and I see a bucket of cockles. This year alone I have had ducks, Canadian goose, cockles and paua.

The difference between now and then there was a need to put kai on the table because it was traditional it didn't matter how far you went. Sometimes it was on a horse and cart and it became a whole day thing. You all went out and gathered. … But that is all gone now. There is not a need now. But we need to exercise our customary rights. There is a perception out there that the river belongs to the trout. One of the main things when talking to Fish and Game. In the past there were eel drives where they would put them up on the banks and let them rot. This was to protect the trout.….

6.1.10 Perception of the environment

Questions sought information from interviewees about how they perceived:

- the abundance of kai species;
- the condition of sites from which kai is sourced;
- the changes to their gathering behaviours; and
- barriers to gathering.

The results in relation to the first three dot points have been discussed in the previous paragraphs. With respect to the perceived barriers, the results show that opinions varied. The results are collated and listed below, and complemented by the quotes of interviewees where appropriate.

Government and council actions acting as barriers

- Need for authorisation, permits and licenses before gathering – that restricts quantities to be gathered and the seasons of gathering.

- Introduction of the Quota Management System (QMS) for highly valued species (e.g., eels) and as a result commercial over-harvesting threatens populations.

- Mismanagement of waters, lands and resources by regional and district councils.

- Lack of any management input by Maori over lands, waters and resources.

- Lack of support to undertake stock assessments of valued species and if necessary implement restorative programmes.

- Redefinition of the customary right to a "non-commercial" right thus preventing restoration of bartering and trade.

Mahinga kai gathering is no longer able to be undertaken according to tikanga. Over time the cumulative effect of settlement and government regulation changed both the circumstances and practice of kai gathering, with both the river environments and the fisheries impacted. Many whanau no longer live in the catchment, kai is not their livelihood, and kai no longer their staple diet. Regulation tries to dictate what they gather, where they gather, and when they gather. But this knowledge – what, how and when - is the basis of matauranga – the knowledge that Ngai Tahu are supposed to possess. In other words the changing face of mahinga kai as a result of regulation also led to the practices, decision-making and knowledge generating processes associated with mahinga kai being changed or alienated from many Ngai Tahu resource users.

Environmental problems acting as barriers - South Canterbury has been heavily impacted by agricultural development and to a lesser extent urban and industrial development. Informants voiced their concerns at environmental conditions which they argued kept them from gathering kai:

- Sewage/contaminants from septic tanks, town sewerage schemes.

- Scarcity/limited availability of resources.

- Over-harvesting of resources.

- Intensification of agricultural land uses.

- Run off from farmland, especially from dairy farms.

- Discharges from industry e.g., scours mills, freezing works.

Land tenure change - Without doubt land loss alienated many whanau and hapu from mahinga kai gathering:

- Private land – many of the lands across South Canterbury were taken up by settlers by the late 1860s.
- Inability to gather on DOC lands.
- Recreational hunters/fishers gaining prominence.
- QMS instituting a property rights regime.
- Locked gates on private property limits access.

The most densely settled areas in South Canterbury are along the coastal margin while the river valleys that are ecologically productive and previously supported intensive mahinga kai usage, now sustain intensive agriculture.

Lack of Traditional Knowledge creating barriers - The practice of mahinga kai represents generations of learning and teachings about places, the resources they yield and the methods of gathering and processing resources. Internationally there are ongoing discussions about the loss or erosion of traditional knowledge as indigenous communities become more integrated into regional or national economies (Inglis 1993, Berkes 1994). It is recognized, however, that it is important to differentiate, between situations where matauranga held by hapu and whanau is adapting to new environments and economic conditions and where matauranga is being lost due to a disruption of its transmission.

But to understand ecological knowledge one must participate in the processes of hunting, fishing, gathering and processing of kai. In other words whanau with a history of use and those who continue to use waterways and resources are those that retain and continue to generate the matauranga. In this way, directly or indirectly, the whanau is the main perpetuator of the Ngai Tahu way of life and stories.

The data sourced from rangatahi suggest that they are experiencing the consequences of the loss of knowledge generation processes, while the comments of pakeke suggest they are losing the opportunities to teach. It is encouraging, however, that not all this knowledge is lost and given the opportunity, would be able to flourish in a re-invigorated cultural context.

As whanau explained –

Watercress you have to go upriver to get decent looking watercress because below the bridge you still got that backwater coming back it must build up and still come back and you can taste it. But up river the waters still flowing through and even the trout still taste better than below the bridge.

I go to the Orari if I want to catch some flounders as the river is free flowing.

Mouth open running straight should be….. It should be straight out so it can come in and then out to clean it out.

I have taken an eel from a good drain toward Clandeboye. It was a old haunt there. But I didn't eat it as it smelt of cow dung and I never went there again.

The things destroying the river are 4wd and motorbikes. They think it's a big deal to drive up the riverbed but they don't know what they are destroying.

They have put the price of rubbish dump up and what people are doing now are they are dumping along the riverbank now. It's a council issue.

I believe there are health risks because of practices over the years like the wool scour. We don't know what chemicals are going in and what that is doing to the watercress and the tuna. The other one that worried me were the timber mills around the area and I am always suspicious of the chemical they are using.

6.1.11 Health and wellbeing of whanau members – the mixed methods and contradictions

Toxic contamination and the resultant health impact on humans has received considerable research attention over the past three decades (Edelstein, 1988; Freudenberg, 1984; Perrow, 1984). This research seeks to explore the potential health consequences of the changing kai gathering behaviours sourced by whanau and hapu in order to determine the ongoing risk of exposure to contaminants.

Ngai Tahu continue to be dependent upon kai gathering both physically and culturally. Mahinga kai was the primary food source and the basis of an economy based on trade, barter and exchange. The transition from wild sourced kai which in the case of South Canterbury numbered more than 30 species to a western style of diet comprising commodity/convenience foods consequently impacted Ngai Tahu socially, culturally, economically and spiritually.

Physical health - Physical health is directly linked to the quantity and quality of food consumed, as well as the cultural, social and economic conditions within which individuals live. In the context of this research programme, physical health consequences arise from four factors:

1. changes in the nutritional value of foods consumed today compared to their traditional diet;
2. being denied access to gather also affects health by limiting the physical exercise associated with the act of gathering;
3. the risk of contamination of kai that is consumed;
4. the risk of contamination from the sites that kai is gathered from.

The loss of access and use of traditional resources is now recognised as being a contributor to a change to a western style of diet and the consequent rise in diet related illnesses which from an economic perspective could cost society. However the converse is also of concern as for those whanau who still gather kai there is a risk of exposure to contaminants from eating wild sourced kai.

An important health benefit of kai gathering results from the act of gathering itself – an activity that requires physical activity. The importance of exercise to general physical health is widely recognised. Traditionally Maori got a lot of exercise in the course of gathering kai. Although the amount of exercise that whanau get now as a result of gathering has declined, those surveyed reported engaging in some activity, although the frequency of such activity has declined as gathering behaviours have changed. However, it cannot be assumed that all gathering will be beneficial as the physical act of gathering resources could expose whanau to health risks as the sites where gathering occurs, specifically the waters and sediments, could be contaminated. The levels of contaminants in kai gathered and the environments in which they are found, will be reported separately. In addition, models describing possible risk to tangata whenua will be developed as part of the risk assessment and communication component of this project.

Wellbeing - The benefits derived from being in natural settings are also gaining increased recognition (Kaplan & Kaplan 1977, 1982). In addition to the data on diseases within the family (using data obtained from the Kai Consumption Survey), the interviewees described the broader social, economic and cultural impacts resulting from the changing patterns of kai gathering and consumption on their wellbeing – as individuals, as whanau and as a collective. The comments of informants describe the contribution of gathering and eating kai on wellbeing.

6.2 Implications for future management

The results of the Kai Consumption Survey show that the gathering and consumption of kai awa, kai roto and kai moana is highly complex. This is in terms of both the differences in availability of kai awa, kai roto and kai moana between hapu, the diversity of aquatic habitats, and the diversity within and between whanau. There is some indication that consumption levels are also related to the quality of kai awa, kai roto and kai moana that is available and the quality of aquatic ecosystems that they come into contact with when gathering. These results enable us to make a number of observations with respect to future management.

Sites from which kai is gathered - Where and when people gather kai is a function of the location of their work, the proximity of waterbodies, and other activities of a whanau. This is supported by Garaway (2005) who argues in relation to fishing that it is almost always combined with other activities. The Kai Consumption Survey confirmed that whanau are likely to go fishing in a nearby lake or stream thus reducing the time spent travelling between areas of work, home and collecting. For Ngai Tahu this means gathering from the lowland reaches of streams that are some of the most degraded in Canterbury. While many of the scenically attractive braided rivers of Canterbury attract attention from environmental organisations seeking their protection, it will be interesting to see who in the community, aside from Te Runanga o Arowhenua, will put their hand up to protect the many small waterbodies that support kai gathering.

Preferred kai species consumed - Knowing the preferences of whanau is essential if restoration initiatives are to target the priorities of whanau and hapu. If resources available for such initiatives continue to be limited, targeting funds to priorities is inevitable. A related concern that emerges when whanau do identify their preferences is that there are very few surveys undertaken to determine a "population baseline". Without this information it is difficult to determine what a sustainable level of customary harvest is.

Perceived changes in the abundance of species - If Maori are interacting with aquatic ecosystems on a regular basis they are ideally placed to observe changes – to sites and to species. Guidance is needed to ensure that their observations are part of a structured and robustly designed perception study so that they are not to have their observations dismissed as being "anecdotal". However, the challenge will be that few agencies support perception based assessments – let alone prove that a species is at risk and in need of management intervention.

Kai gathering behaviours - There is a complex mosaic of uses and users of aquatic resources within a takiwa that collectively shape the livelihoods of whanau and hapu. Kai gathering cannot be classified as one activity. Instead, they are part of a complex combination of activities for a range of members in a household. As the survey shows whanau hunt, and tend fruit and vegetable gardens. The effort afforded to gather kai is not a homogenous activity – it is a flexible activity that is undertaken by different people, at different times, targeting different species from different waterbodies using a range of equipment. Collectively this confirms a complex relationship between humans and their environment. It is important that information continues to be collected to increase our understanding of these range of behaviours, including their aspirations.

Disseminating advice about contamination issues - Furgal (1999) and Grondin and Carron (1999) argue that we need to consider both formal and informal networks when it comes to the circulation of information. Data from the Kai Consumption Survey confirms the need for formal and informal networks and suggests that advice could be provided by Health Protection Officers and Environmental Protection Officers, Maori Health Workers and whanau members.

While Maori have been active in developing relationships with resource management agencies, formalised relationships with the parties that can undertake the research necessary to understand contamination issues and deliver the messages, may need to be developed**.**

7. The next steps in the research process

Maori are faced with a "Catch-22" – whanau and hapu want to continue to undertake cultural activities, such as kai gathering, that they contend are central to "who they are". However because of the risk of exposure to contaminants, these same cultural activities could be the cause (and not the cure) of some of the ills being experienced by whanau and hapu.

This report has shown how looking beyond simple representations, such as consumption, reveals the complex and diverse role of both kai awa, kai roto and kai moana in the behaviours of whanau and hapu. Further, kai awa, kai roto and kai moana are accessed in diverse and complex ways.

The results from the Kaimoana Consumption Survey clearly support the statements found in archival records, and as articulated to the Waitangi Tribunal in 1989-1990 that kai awa, kai roto and kai moana are vitally important to whanau and hapu in South Canterbury. It appears that, consistent with the cultural values of whanaungatanga and manaakitanga, there is significant distribution of kai outside of whanau. For hapu, kai awa, kai roto and kai moana continues to represent a food source upon which all members of a hapu can subsist if the health and abundance of species and the condition of valued sites are assured.

Kai awa, kai roto and kai moana are also represented in terms of their wider social and cultural importance. Being able to maanaki visitors and provide kai sourced from your takiwa remains of fundamental importance. Other forms of provision, such as purchasing kai and / or having it supplied through systems such as pataka, have drawn on the social and cultural values associated with gathering kai awa, kai roto and kai moana to be legitimised within both Maori and government institutional planning. Arguably the outcome is that kai awa, kai roto and kai moana threatens to be reduced to 'availability' and species is increasingly becoming synonymous with supply from commercial fishers rather than customary gathering.

7.1 Next steps

Using the site specific data and the species data that resulted from the Kai Consumption Survey, the next stage of the research will identify the types and levels of contaminants present in the "wild kai" and associated habitats identified by Maori.

The analyses that are proposed at the next stage will then enable the researchers to establish potential pathways of contaminant bioaccumulation via the food web. This information will then be available to whanau from Te Runanga o Arowhenua.

7.2 Disseminating advice about contamination issues

> *Communicating the risks of environmental contaminants in the food chain to northern Aboriginal peoples poses significant challenges for communities at risk and environment and health professionals alike..… communication practice on this issue include increased fear and confusion in northern communities, changes in the dietary behaviour and traditional lifestyles of their residents, and associated impacts on their society, economy, and health. … The importance of this information is increasing as research begins to detect subtle health effects from exposure to these substances among newborns in some northern regions. Thus planning and evaluation are needed for risk communication, and possibly changes to the scale at which communication work is done in northern communities.* Furgal et al., (2004).

Frugal (2003a) contends that some of the challenges associated with communicating contamination risks are unique to the specific issue and the context of communities. This chapter has repeatedly stressed the contradictions or the Catch 22 that Ngai Tahu find themselves as a result of trying to balance two potentially conflicting perspectives:

1. the health and wellbeing benefits that results from the continuing practice of gathering kai or conversely the impacts that arise when changing from a traditional lifestyle and diet; and
2. the adverse impacts on health and wellbeing arising from contamination of aquatic ecosystems and the potentially the kai species themselves.

The cultural comprehension of what is “risky” behaviour is complex. Maori, like those in other indigenous communities, have limited experience with food safety issues similar to that of contaminants in foods they gather.

Understanding how indigenous communities perceive contaminants, has significant impacts on the reception and effect of messages delivered. Usher et al., (1995) contend that communities may distrust the information they receive about contaminants in foods and their distrust could affect their reception of further explanations or clarifications. Furgal et al., (2003a) found that concerns over contaminants was not a determinant of food choice in one Labrador community, yet Kuhnlein et al., (2003) reported that 42% of women interviewed in five western Arctic communities indicated “concern over contaminants” as a reason why they did not serve more foods to their families. The objective of this research is to effectively

convey to Maori the risk of gathering kai. Overseas research indicates a number of aspects need to be addressed.

The advice to be delivered - A minimal amount of work has been undertaken to identify the types of messages that elicit certain or desired responses. Usher et al., (1995) indicates that good messages are direct, simple, not condescending, put in a personal context, accurate, translated into local languages, delivered early and often, and build upon local understandings and knowledge of the issue.

Materials to be presented - Numerous forms of materials have been used to communicate messages on contaminants and country food in North America including posters, fact sheets, reports, pamphlets, personal letters, radio public service announcements, radio call-in shows, regional video programs, door-to-door or face-to face communication, community meetings, school curriculum materials, and national live television broadcasts (Furgal et al., 2003b). From the Kai Consumption Survey we know that a range of media are likely to be needed.

Delivering the advice - To be effective a message has to be distributed through pathways that ensure it will reach and engage the target audience - in this instance, hapu members who gather kai. Furgal (1999) and Grondin and Carron (1999), in their work with northern hemisphere communities, identified the need to consider both formal and informal pathways of delivery and information circulation. Data from the Kai Consumption Survey confirms the need for formal and informal networks and suggests that advice could be provided by:

Formal networks:	Health Protection Officers and Environmental Protection Officers
	Maori Health Workers.
Informal networks	Whanau members

Specificity - Vaughan (1995) and Slovic (2000) contend that personal experience, gender, age, socioeconomic status, and profession influence perceptions of risk. Understanding how Ngai Tahu see the issue is critical to ensure that the communication is best oriented towards their understandings and perspectives.

McGrath (2003) argues for a relationship based approach to exchanging knowledge on issues such as contaminants within and between communities. This will require scientists and communicators to understand the informal paths of information flow in communities so they can develop mechanisms that support and utilise these pathways to communicate information about contaminants.

> *One might argue that little true "communication" on the issues of contaminants, food, and health has taken place between scientists, health professionals, and Aboriginal residents in many northern communities; rather, a great deal of scientific information has simply been disseminated* Leiss (1997:29).

Understanding and developing ways to better communicate information on contaminants and their impacts on health is critical. Reports of contamination can undermine confidence of whanau in their environment and gathering of resources as a source of individual and collective well-being.

As whanau explain -

> *All we have is speculative information about kai. If we had scientific information about what's in our kai and the area of where we are gathering kai if it could dangerous then we would make decisions about that.*
>
> *As long as area is clean then it's no problem. Going back to the lagoon it's a big risk to eat from there. I don't know anyone being sick from it. But it would be silly to eat anything from there because you can see the water before you get there.*
>
> *I wish they would do something about the river here. It's getting worse every year. Since the dam has been up we have never had a real flood to clean out river. We have just had a lot of rain and you should smell the lagoon now it smells nice and fresh. It washed the river through. You need that fresh water to clean the river. I may go down to the Opihi this year since there has been a fresh going through it.*

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Tribunal Evidence

J:10, H:1, H:10, H:47, H:49, F:11, P:15(a).

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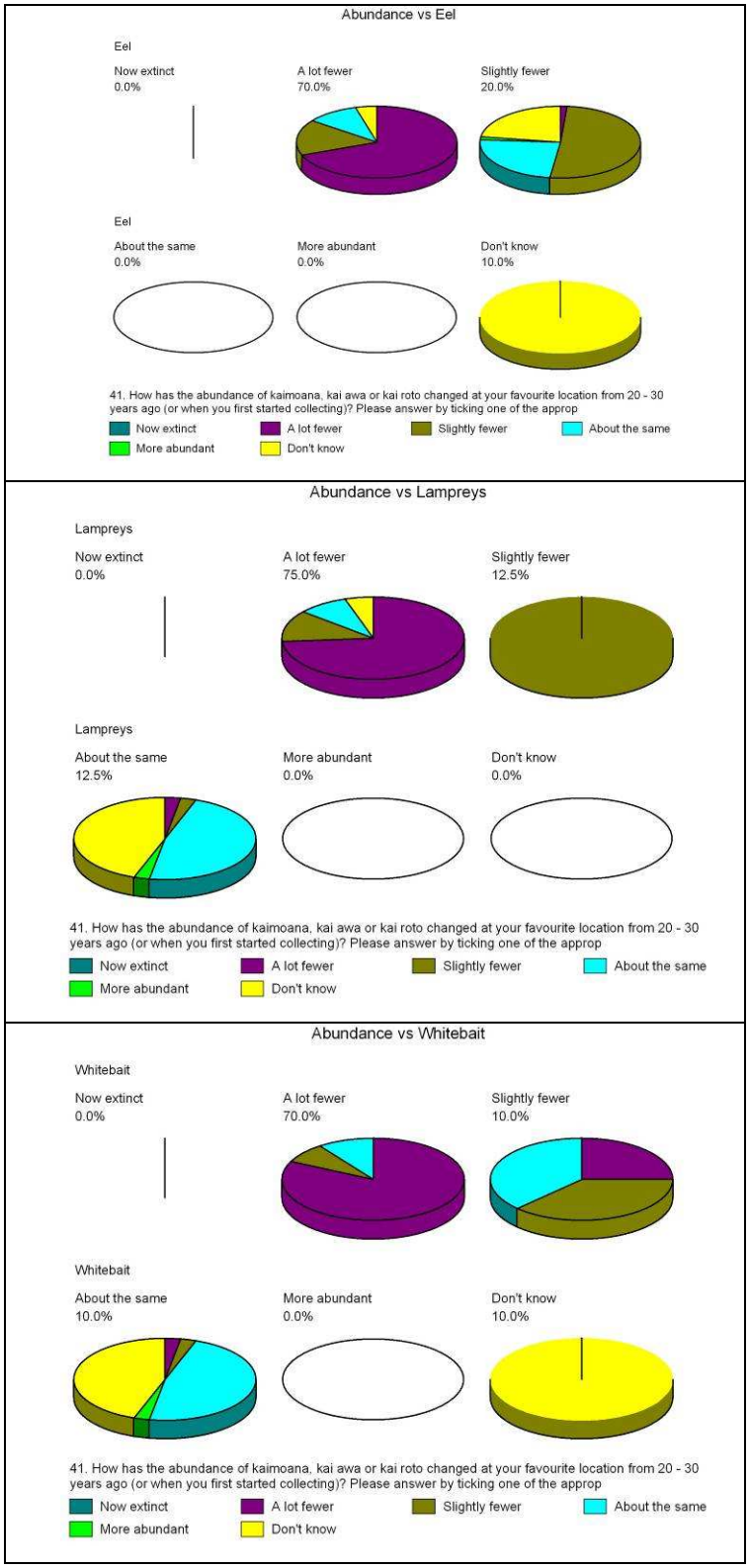
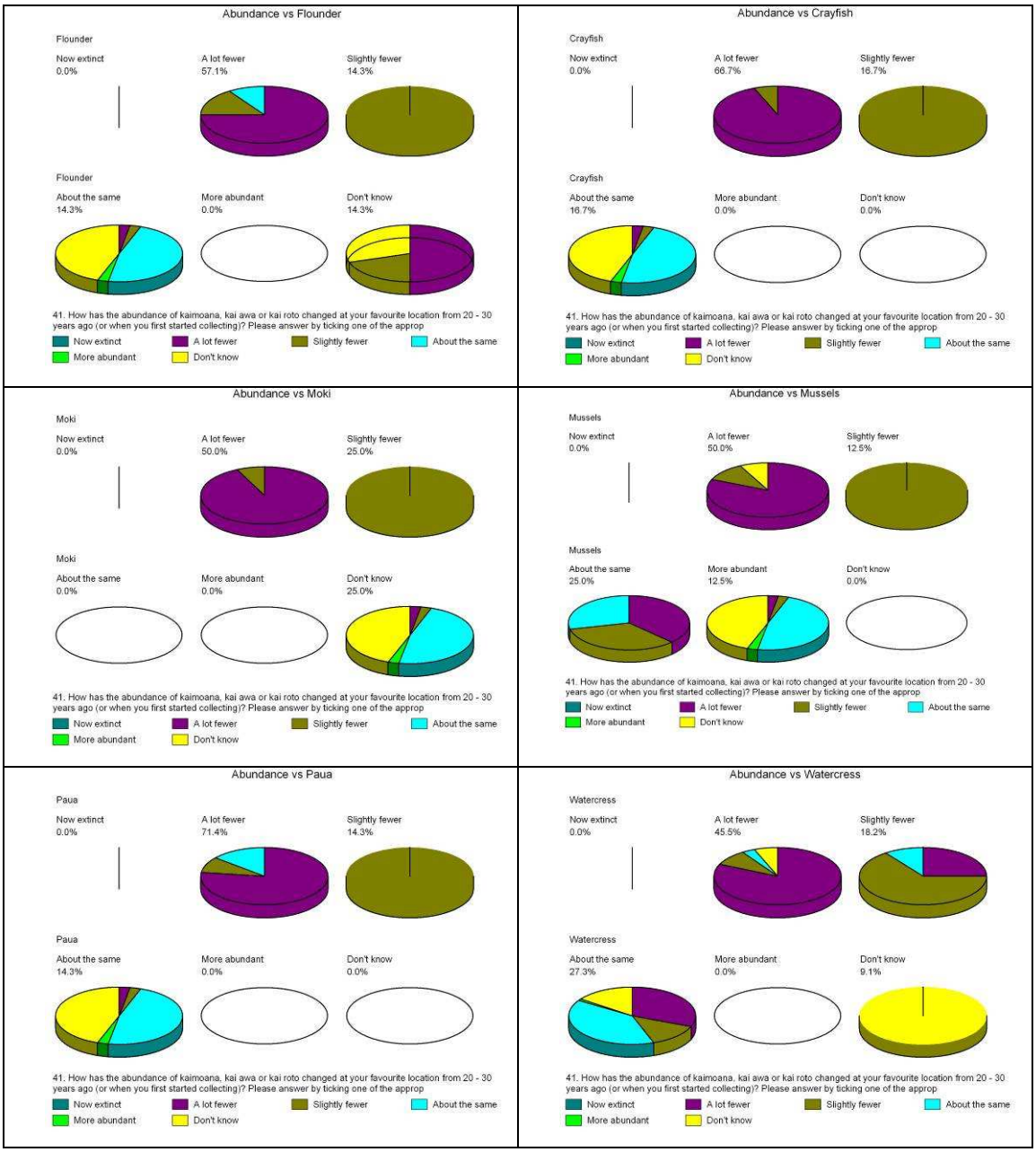
10. Appendix 1: Perceived changes in abundance of species




Abundance vs Flounder
Flounder
Now extinct 0.0%
A lot fewer 57.1%
Slightly fewer 14.3%
Flounder
About the same 14.3%
More abundant 0.0%
Don't know 14.3%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know
Abundance vs Crayfish
Crayfish
Now extinct 0.0%
A lot fewer 66.7%
Slightly fewer 16.7%
Crayfish
About the same 16.7%
More abundant 0.0%
Don't know 0.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know
Abundance vs Moki
Moki
Now extinct 0.0%
A lot fewer 50.0%
Slightly fewer 25.0%
Moki
About the same 0.0%
More abundant 0.0%
Don't know 25.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know
Abundance vs Mussels
Mussels
Now extinct 0.0%
A lot fewer 50.0%
Slightly fewer 12.5%
Mussels
About the same 25.0%
More abundant 12.5%
Don't know 0.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know
Abundance vs Paua
Paua
Now extinct 0.0%
A lot fewer 71.4%
Slightly fewer 14.3%
Paua
About the same 14.3%
More abundant 0.0%
Don't know 0.0%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know
Abundance vs Watercress
Watercress
Now extinct 0.0%
A lot fewer 45.5%
Slightly fewer 18.2%
Watercress
About the same 27.3%
More abundant 0.0%
Don't know 9.1%
41. How has the abundance of kaimoana, kai awa or kai roto changed at your favourite location from 20 - 30 years ago (or when you first started collecting)? Please answer by ticking one of the approp
Now extinct
A lot fewer
Slightly fewer
About the same
More abundant
Don't know

11. Appendix 2: Sites and species identified by iwi participants (number of respondents)

Kai	Opihi River upstream of SH bridge	Opihi River below SH bridge	Opihi River Mouth	Orari River Upstream of SH bridge	Orari River Mouth	Ohapi Creek	Temuka River	Waihi River	Te Hae Hae Te Moana	Jacks Point	Washdyke	Otaio River	TOTAL	Other
Watercress	6	7	3	3	4	2	5	3	2				**35**	Awarua (x3), Temuka, Te Umukaha
Eel	7	4	3	2	2	2	5	3	3	1	1	1	**34**	Te Umukaha
Trout	5	3	2	1	2	1	5	2	1	1	1	1	**25**	Te Umukaha
Whitebait	1	4	6		3		3				2		**19**	
Flounder	1	2	5	1	2		2			1	3		**17**	
Herrings		2	3	1	1					1	1		**9**	
Lampreys	1	1	1		1		2	1			1		**8**	Waihao
Mussels										5	1		**6**	Timaru (x2), Teaitaraki, Jacks Point, Moeraki
Kahawai			2		1					1			**4**	Teaitaraki
Mullet		1	1							1	1		**4**	Teaitaraki
Oysters										1	2	1	**4**	Patiti Point, Bluff
Shark			2							1			**3**	Moana
Puha							3						**3**	Temuka, Te Umukaha, Awarua (x2), all over
Paua										3			**3**	Teaitaraki, Jacks Point, Moeraki
Seaweed										1	1		**2**	Wales
Crayfish										1			**1**	Kaikoura, Teaitaraki (x2), Moeraki
Kina										1			**1**	Teaitaraki
Muttonbirds													**0**	Titi Island (x3), Papatea
Cockles													**0**	Warrington, Karetane
Freshwater mussels													**0**	Pareora (x2)
Tuatua													**0**	Teaitaraki
Freshwater crays													**0**	Pareora (x2)
Greenbone													**0**	Papatea, Bluff
Toheroa													**0**	Oreti
Pupu													**0**	Moeraki
Hapuka													**0**	Moana
Kingfish													**0**	Nelson
Snapper													**0**	North Island
Moki													**0**	Timaru
Tarakihi													**0**	Timaru
Trevally													**0**	Timaru